OKI MICROLINE
390/391 Elite

MAINTENANCE MANUAL

PREFACE

This maintenance manual describes field maintenance of the Microline 390/391 Elite printer and options for maintenance personnel.

For performance specifications and operating procedures, refer to the “User’s Manual”.

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1. CONFIGURATION

1. CONFIGURATION

1.1 Standard Printer Configuration

The standard configuration of the ML390/391 Elite is as follows

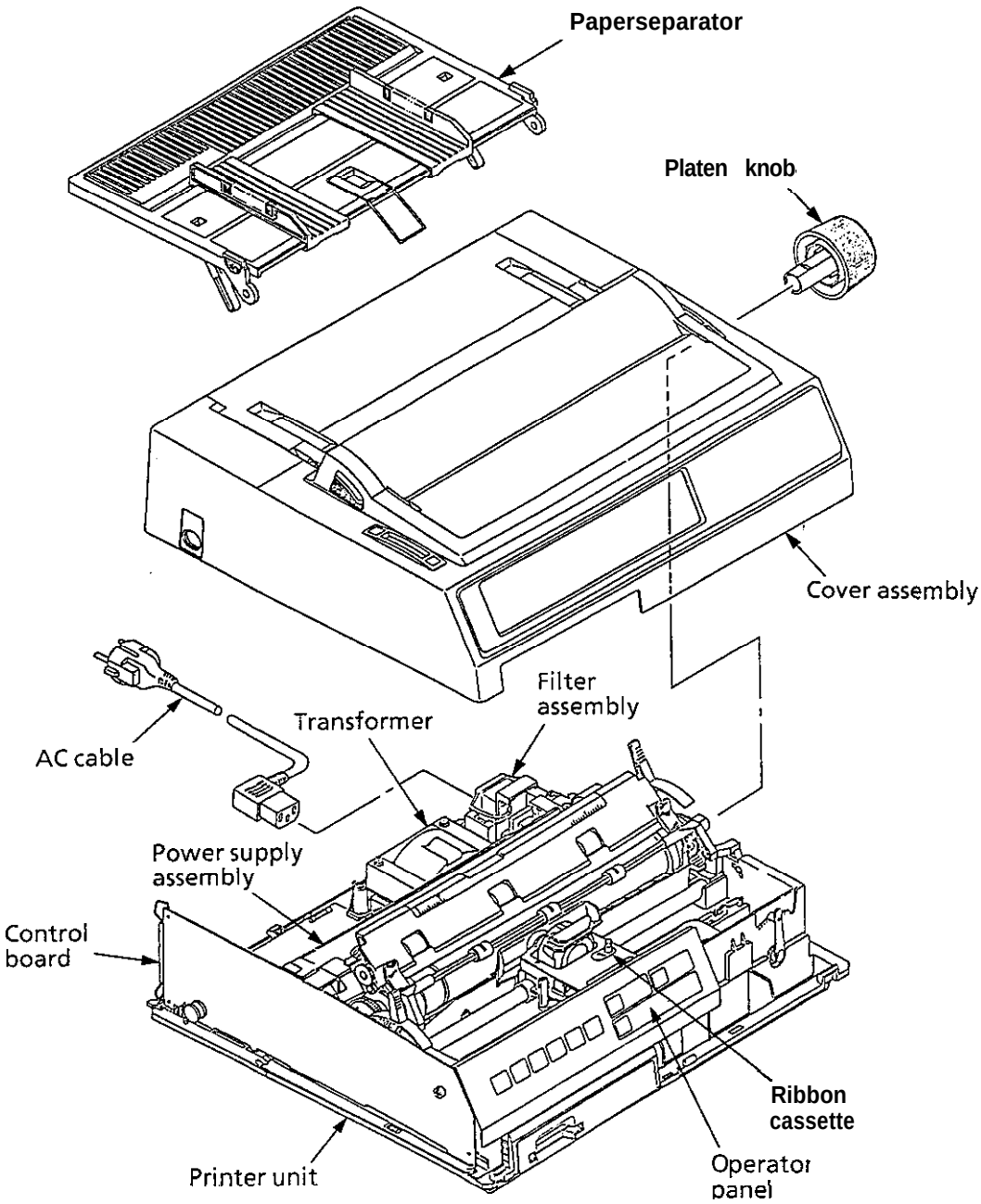
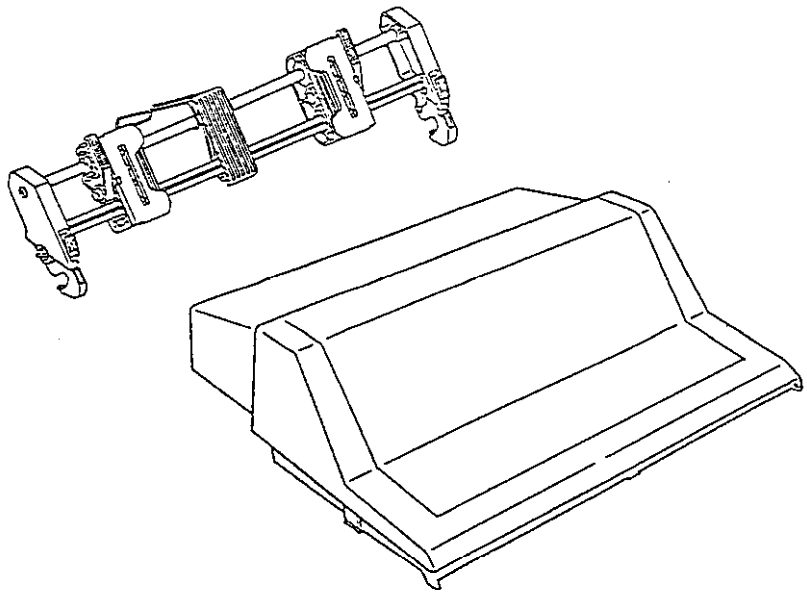


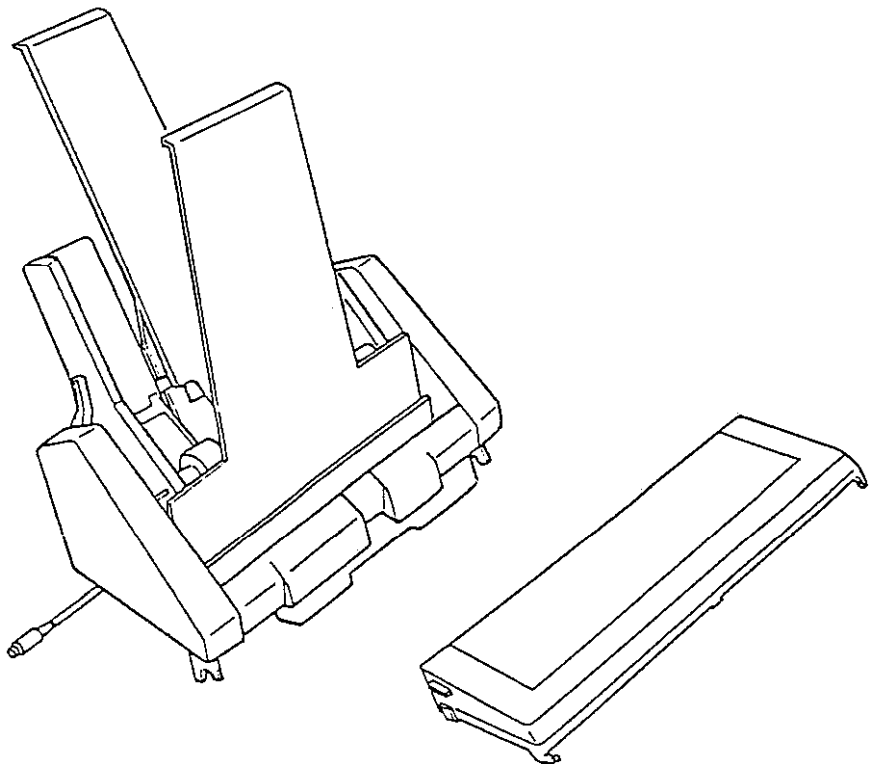
Figure I-I Printer configuration

1.2 Options

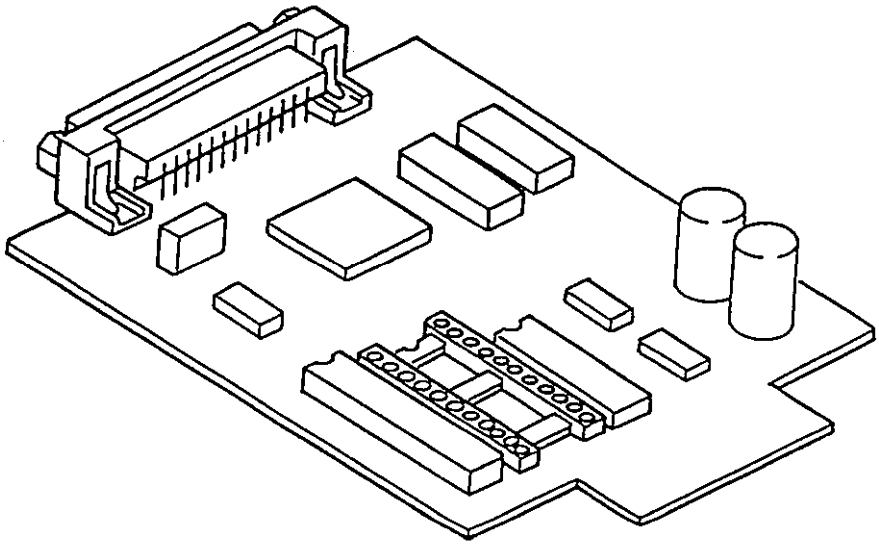
(1) Tractorfeed unit with acoustic cover



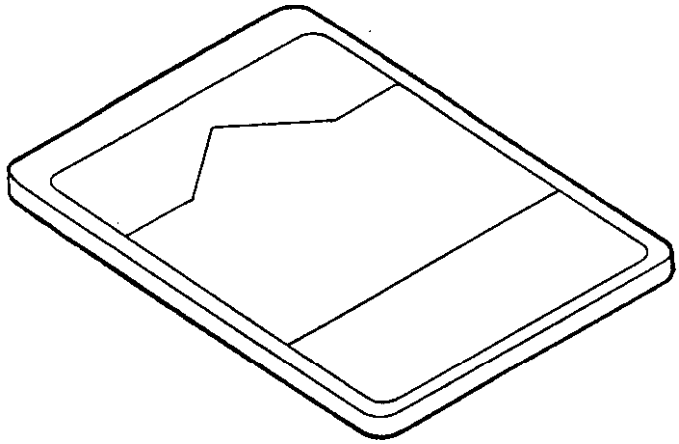
(2) Cut-sheet feeder unit with access cover



(3) Super-speed RS-232C serial interface board



(4) Font memory card



1.3 Specifications

1.3.1 Print specifications

(1) Print method : Impact dot matrix

(2) Number of dot wires : 24

(3) Dot wire diameter : 0.0079 inch (0.2 mm)

(4) Print direction : Bidirectional, short-line-seeking printing
Unidirectional printing specifiable

(5) Print speed

Print mode	Character pitch				
	10 CPI	12 CPI	15 CPI	17.1 CPI	20 CPI
Utility	225.0 CPS	270.0 CPS	168.6 CPS	192.9 CPS	225.0 CPS
LQ	75.0 CPS	90.0 CPS	112.5 CPS	128.6 CPS	150.0 CPS

(6) Character sets

Standard ASCII
EPSON Character Set
IBM Character Set I & II
IBM Proprinter Compatible Character Set
Foreign Character Substitution
Line Graphics

(7) Character pitches

The following character pitches are selectable through the operator panel* or with control codes:

5 CPI 0.2 inch (5.08 mm)
6 CPI 0.167 inch (4.23 mm)
8.5 CPI 0.117 inch (2.96 mm)
* 10 CPI 0.1 inch (2.54 mm)
* 12 CPI 0.083 inch (2.12 mm)
* 15 CPI 0.067 inch (1.69 mm)
* 17.1 CPI 0.058 inch (1.48 mm)
* 20 CPI 0.05 inch (1.27 mm)

1.3.2 Paper specifications

(1) **Cut-sheet paper**

The standard size : 8-1/2 **inches (wide) x 11 inches (long) for the U.S.**
A4 size : 210 mm (wide) x **297 mm (long) for Europe**
Weight : 12 to 24 lb (45 to 90 g/m2)
Multiple-part paper cannot be used.

(2) **Sprocket paper**

The tractor feed unit can handle sprocket paper of the following widths:

ML390 Elite: 3 to 10 inches (76.2 to 254 mm)
ML391 Elite: 3 to 16 inches (76.2 to 406.4 mm)
One-part paper
Ream weight: 12 to 24 lb (45 to 90 g/m*)
Multiple-part paper: 0.014 inch (0.356 mm) or lesstotal thickness

Number of sheets		Ream weight	Number of sheets
Carbon-lined paper		9 to 11 lb	Up to 4
Pressure-sensitive paper		(35 to 40 g/m*)	including original
interleaf paper	(paper)	10 to 12 lb	Up to 4
		(38 to 45 g/m2)	including original
	(carbon)	9 lb	
		(35 g/m2)	

Multiple-part paper should be fastened by spot-pasting or crimping on both sides, and should be free of wrinkles.

(3) **Cut envelope**

Weight : 24 lbs **(90** g/m2) **or less**
Thickness : 0.016 inch (0.41 mm) or less
Size 6-112 x 3-5/8 **inches**
8-7/8 x 3-7/8 **inches**
9-1/2 **x4-118 inches**

(4) **Multiple-part envelope**

Weight : 24 lbs **(90** g/m2) **or less**
Thickness : 0.014 inch (0.36 mm) or less
Width : 3 to 10 inches (76.2 to 254 mm)
Medium feed : Bottom paper feed only

(5) Card

Weight : 100 lbs (162.8 g/m2) or less
Thickness : 0.008 inch (0.20 mm) or less
Size : 5 x 8 inches (when cut apart)
Medium feed : Bottom paper feed only

(6) Label

Thickness : 0.011 inch (0.28 mm) or less
Size : ML390 Elite-8.5x3.25 inches (216 x 83 mm) or less
ML391 Elite- 15x3.25 inches (381x 83 mm) or less

(7) OHP sheet (transparencies)

Thickness : 0.004 inch (0.10 mm) or less
Size : 8.5 x 11 inches (216 x 280 mm) or less

1.3.3 Physical specifications

(1) Outside dimensions

ML390 Elite : 15.67 inches (398)(W) x 4.57 inches (116)(H) x 13.58 inches (345)(D)
ML391 Elite : 21.73 inches (552)(W) x 4.57 inches (116)(H) x 13.58 inches (345)(D)
These dimensions do not include the platen knob, acoustic cover and paper separator,

(2) Weight

ML390 Elite : 18.5 lb (8.4 kg)
ML391 Elite : 22.3 lb (10.1 kg)

1.3.4 Power requirements

(1) input power

Single-phase AC
Voltage : One of the following as specified: 2201240 VAC + 10% - 10%
Frequency : 50/60 Hz + 2%

(2) Power consumption

Operating : 110 VA
Idle : 40VA

1.3.5 Environmental conditions

(1) Ambient temperature and relative humidity

	Operating	Non-operating	Storage	Unit
Temperature	41 to 104 (5 to 40)	14to 109.4 (-10 to 43)	-40 to 158 (-40 to 70)	°F (°C)
Relative Humidity	20 to 90	5 to 95	5 to 95	% RH

The printer must be packed during storage

Avoid condensation at all times.

(2) Vibration

Operating : 0.3G (5 to 150 Hz) or less (except the unit is resonant frequency)

Non-operating : 1G (5 to 150 Hz) or less (except the unit is resonant frequency)

(3) Impact (Drop test)

Packing : 30" (One corner and three edges and all six sides)

1.3.6 Noise

The 8-second average noise is less than 57 dB(A) (in all mode), 52 dB(A) (in quiet mode) when measured under the above conditions with the printer fitted with the acoustic cover.

1.3.7 Agency approvals

UL No. : The printer is listed in UL STANDARD No. 478.

CSA No. : CSA certification to CSA STANDARD C22.2 No. 220

FCC : FCC certified per Part 15, SUBJECT J, CLASS B.

VDE : VDE 0806.
VDE 0871 Class B.

BS : BS 5850

2. INSTALLATION PROCEDURE

2. INSTALLATION PROCEDURE

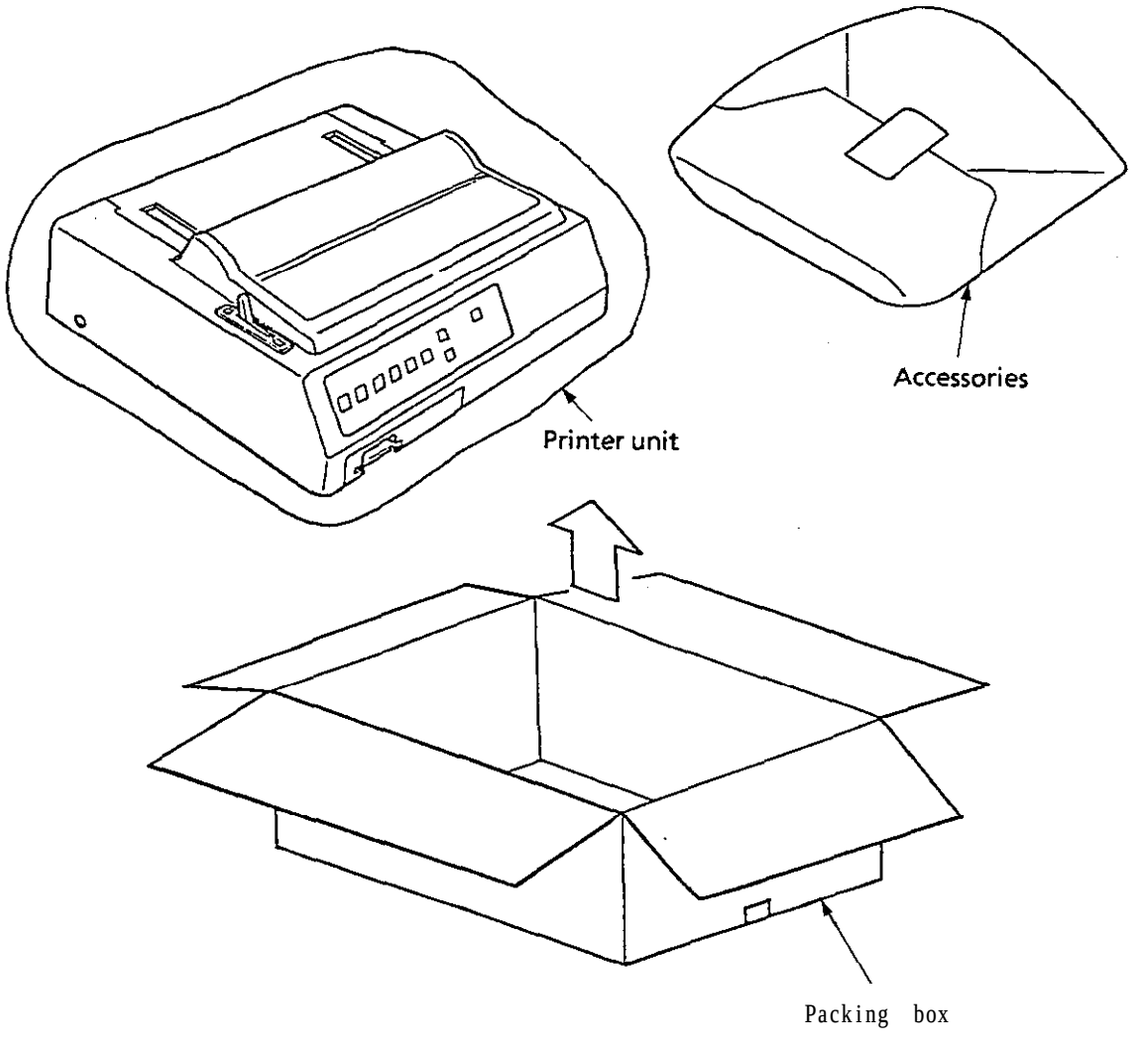
2.1 Unpacking

2.1.1 Unpacking the packing box

(1) Unpackthepackingbox.

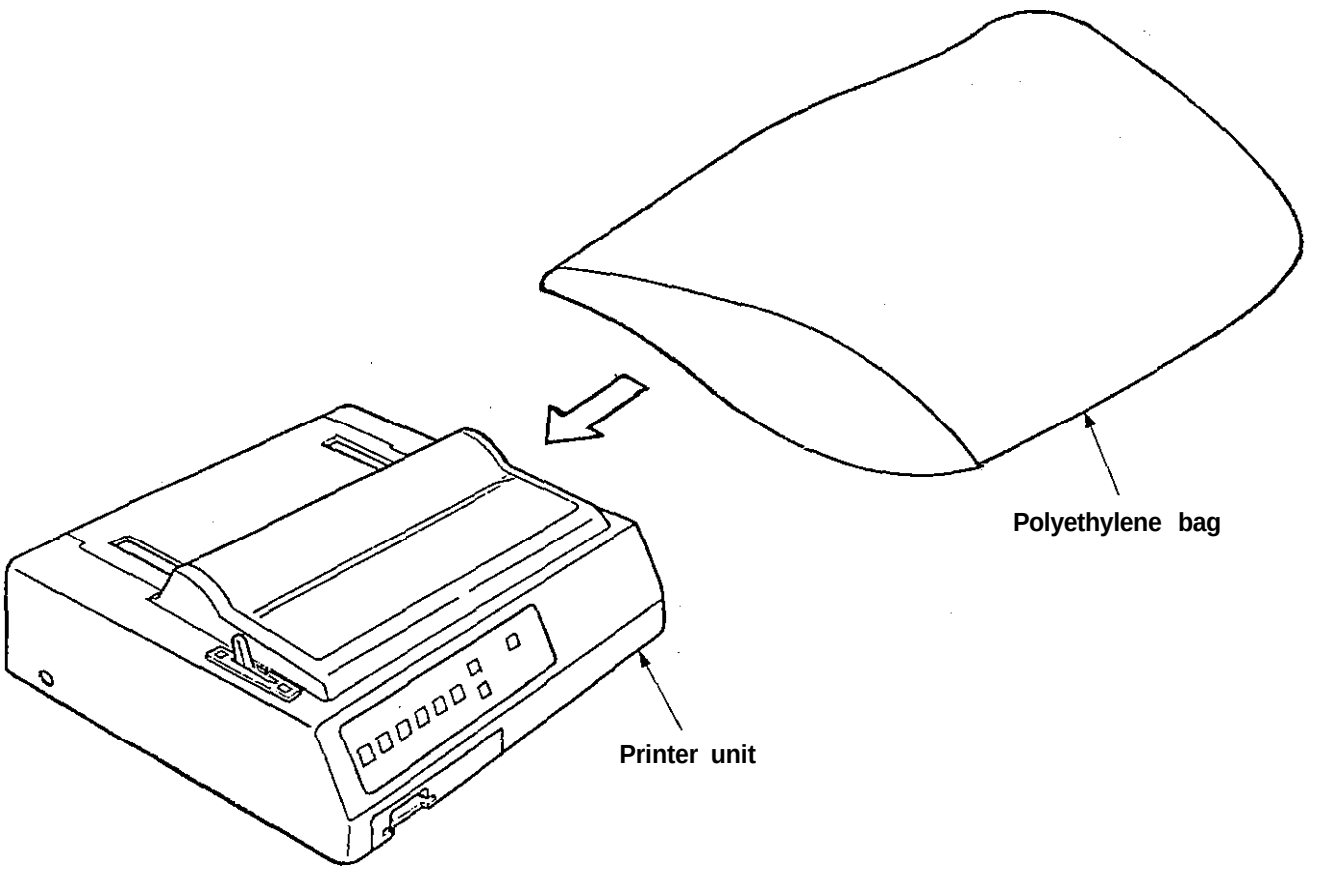
(2) Takeouttheprinterunit.

(3) Takeouttheaccessories.



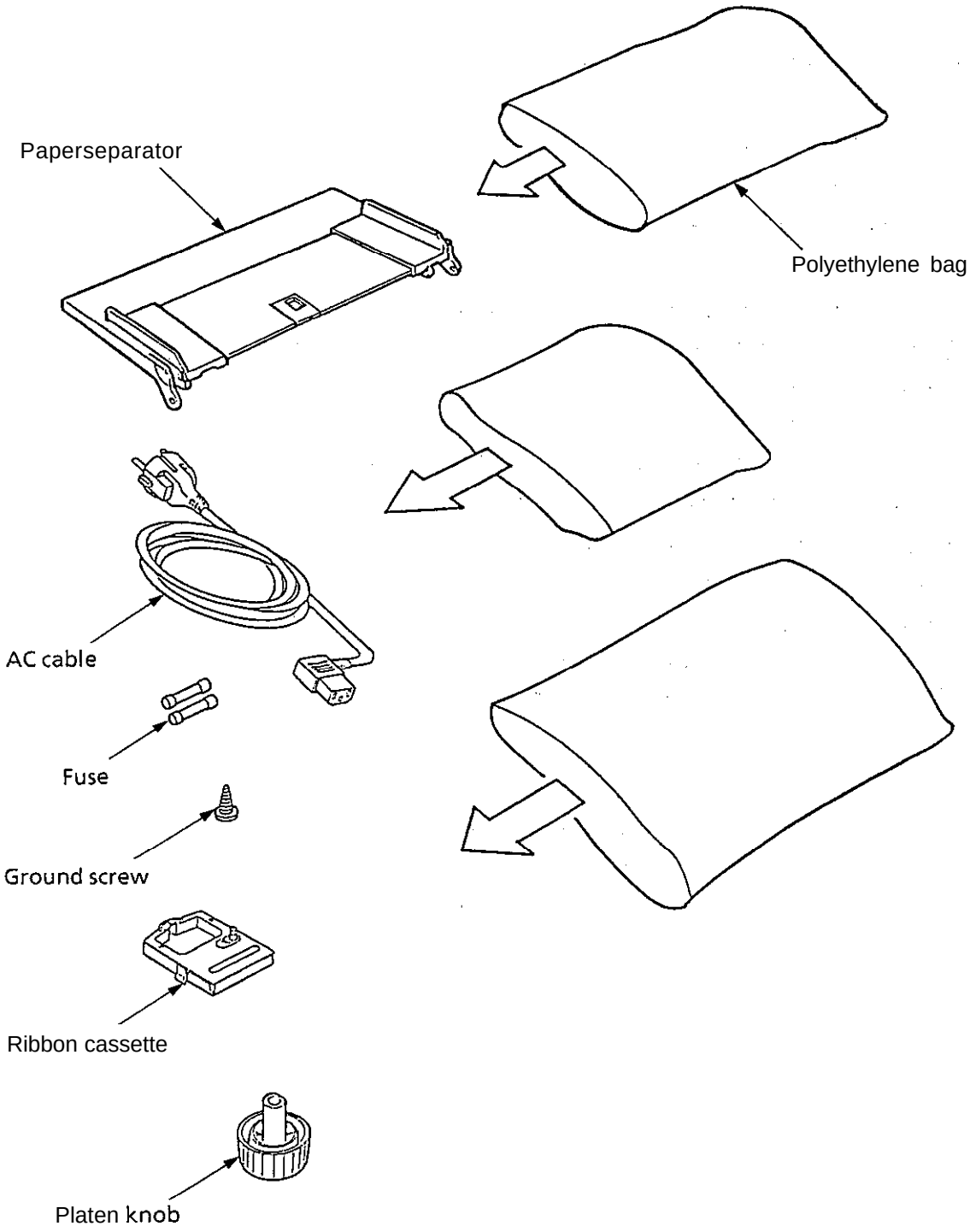
2.1.2 Unpacking the printer unit

(1) Removethe printer unit from the polyethylene bag.



2.1.3 Unpacking the accessories

(1) Remove the AC cable, fuses, paper separator, platen knob, ground screw, and ribbon cassette from the polyethylene bag.



2.2 Installation (Refer to the User's Manual for Details.)

2.2.1 Precaution for installation

Pay attention to the following when installing the printer:

(1) Do not install the printer in the following places:

(a) Any place exposed to direct sunlight.

(b) Any place with great fluctuations in temperature.

(c) Any place exposed to outdoor wind.

(d) A dusty place

(e) Near a door

(f) Near an air-conditioner.

(g) Any place with heavy vibrations.

(2) DO not smoke in the area where the printer is installed.

(3) Adjust the temperature and humidity of the installation site as follows:

Temperature : 41 to 104°F (5 to 40°C)

Humidity : 20 to 90% RH

(4) Place the printer and continuous form in the following procedure:

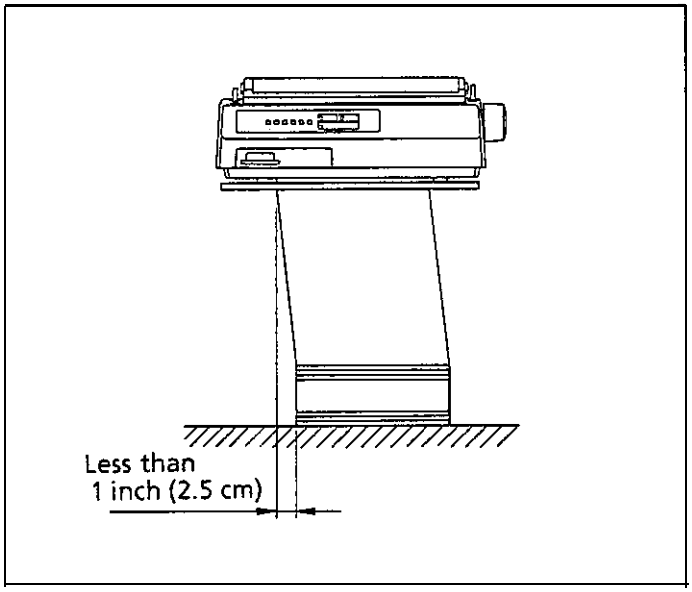
1) The height of the desk for the printer is 28 inches (70 cm) standard.

(Install the printer on a level and flat desk or stand so that its four rubber feet fit flatly on the surface.)

2) Paper positioning

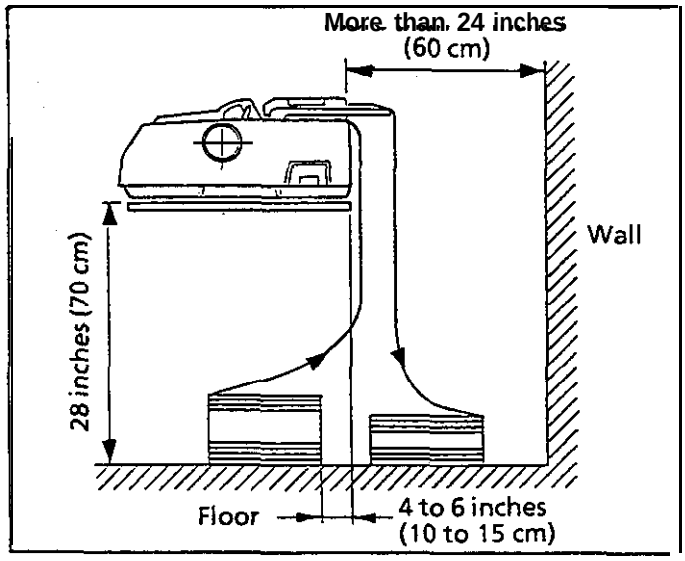
Place forms in parallel with the paper feed path.

The positioning tolerance of the left and right direction should be less than 1 inch (2.5 cm).



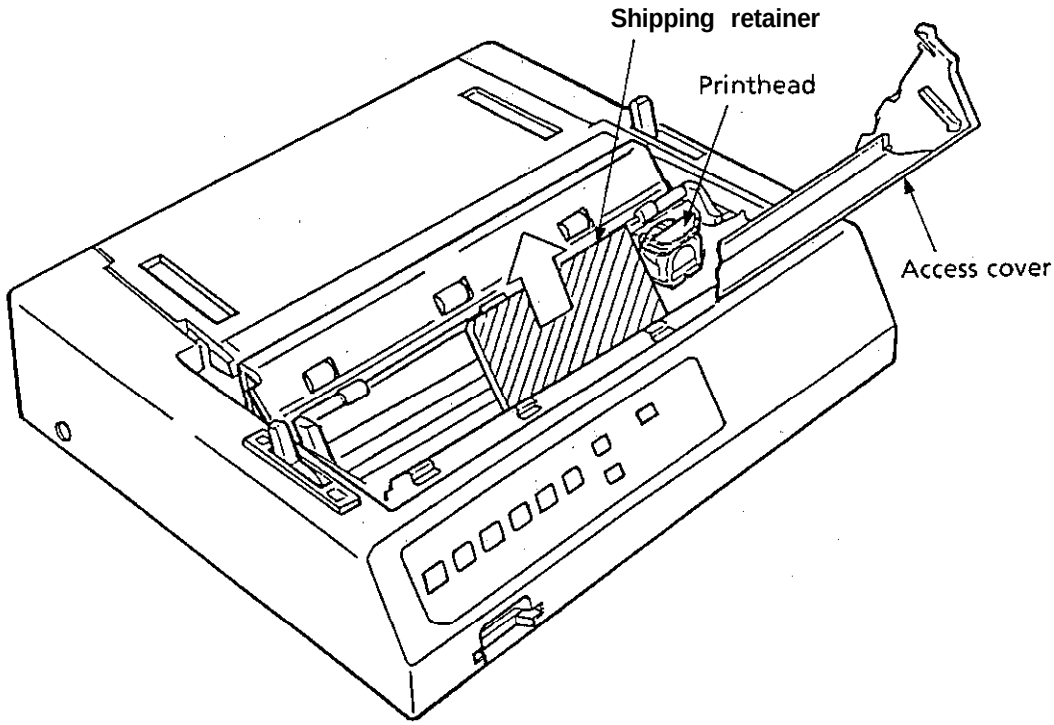
3) Printer rear space requirement
Match the rear part of the printer with the edge of a desk.
Leave a space of more than 24 inches (60 cm) at the rear of the printer to allow sufficient space for paper.

4) To prevent incoming and outgoing forms from interfering with each other, place the forms within 4to 6 inches (10 to 15 cm) from the edge of a desk.
Paper jamming **may occur if forms interfere with each other.**



2.2.2 Removing the shipping retainer

Remove the shipping retainer which secures the printhead from movement during shipping by opening the access cover.

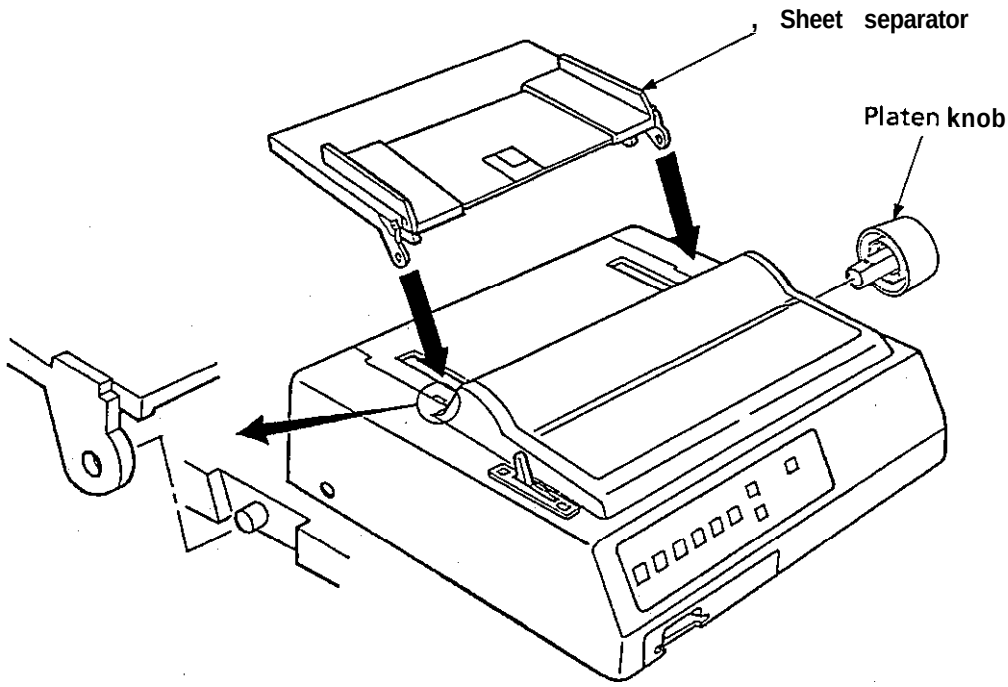


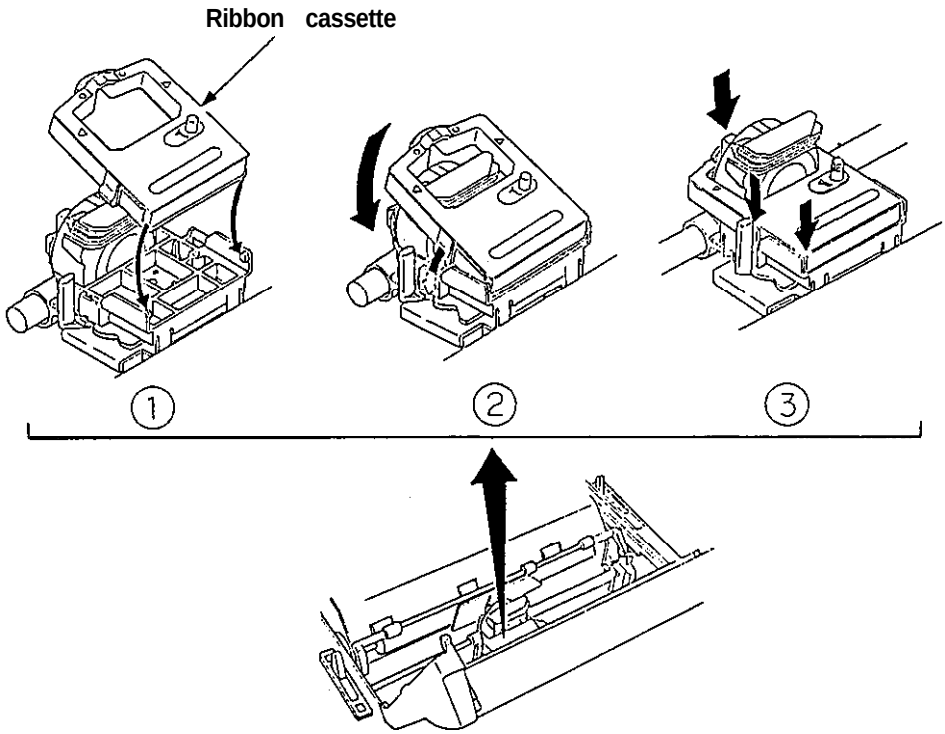
2.2.3 Installing the accessories

(1) Install the sheet separator.

(2) Install the platen knob.

(3) Install the ribbon cassette.



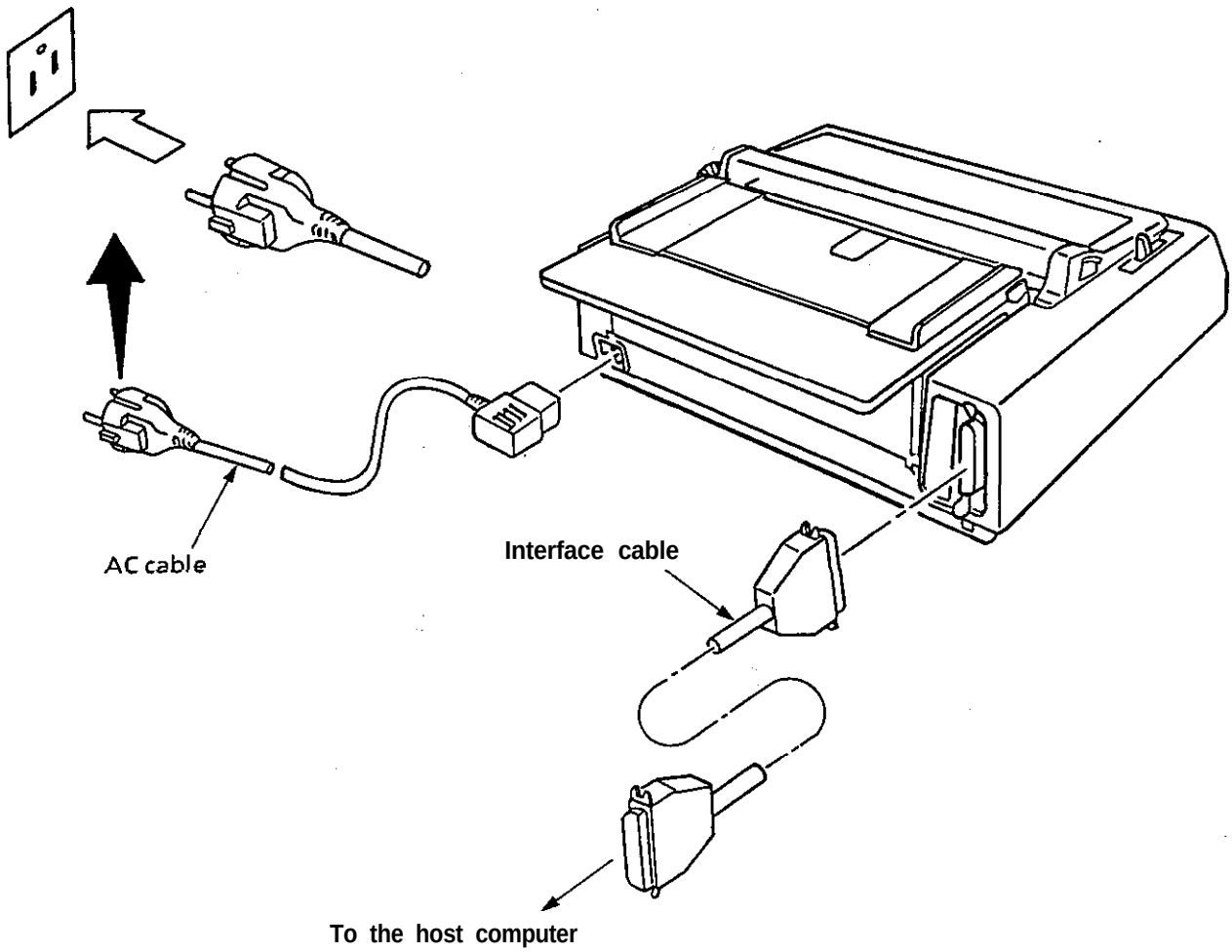


2.2.4 Connecting cables

(1) Connect the interface cable,

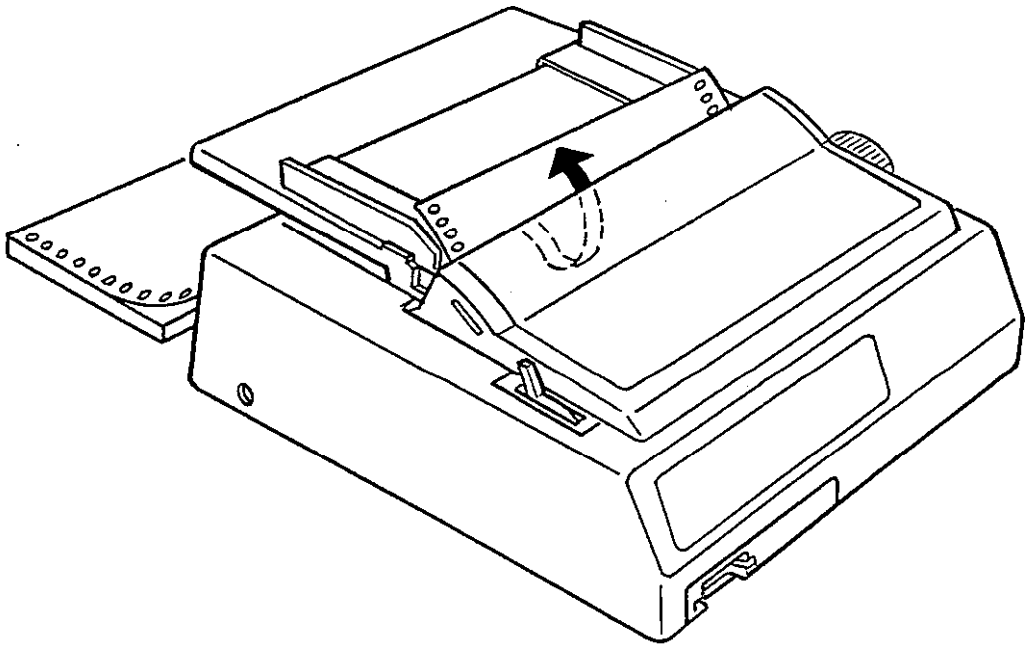
(2) Connect the AC cable.

Make sure that the AC power switch on the right side of the printer is set to OFF side (the side marked with 0).



2.2.5 installing paper

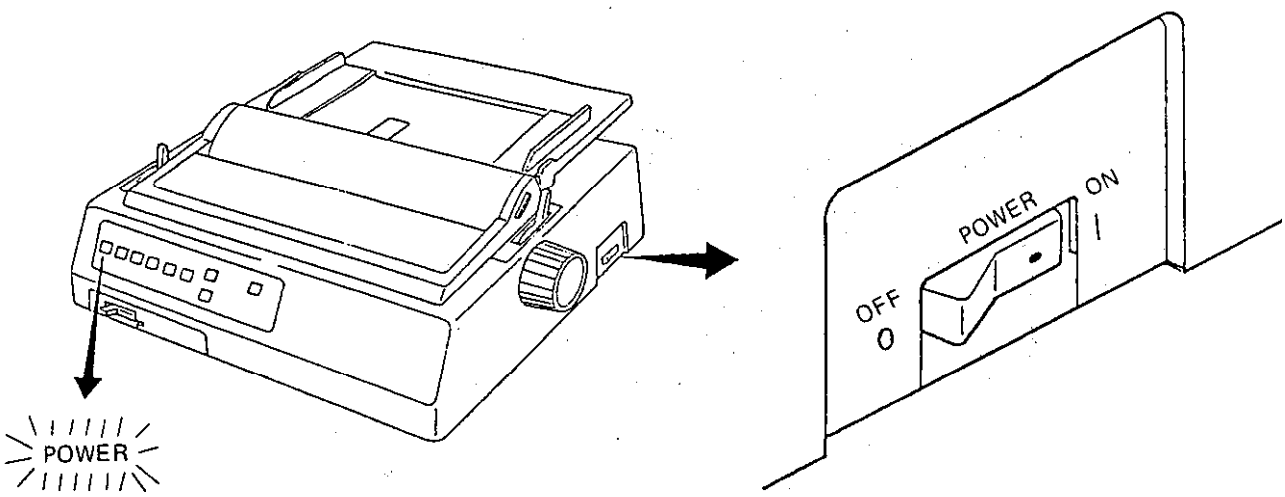
Install continuous form paper to test the unit. (Refer to User's Manual for Details).



2.2.6 Powering on

(1) Push the AC "POWER" switch on the right side of the printerto "ON" (the side marked with I)

(2) Confirm that the "POWER" lamp goes on and the printhead returns to its home position.



2.2.7 Rolling ASCII test pattern

(1) Confirm that the "POWER" switch is OFF and while pressing the "TOF/QUIET" switch, press the "POWER" switch to "ON".

(2) The rolling ASCII pattern as shown below will be printed.

(3) To finish the test, press the "MODE" switch.

(4) The "SEL" lamp will go on, indicating that the printer unit is ready to receive printing data from the host computer.

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnop
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopq
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqr
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&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstu
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456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$
56789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%
```

3. THEORY OF OPERATION

3. THEORY OF OPERATION

3.1 Electrical Operation

This section describes the electrical operation of the printer circuits.

3.1.1 General

The block diagram of the printer circuit is shown in Figure 3-1.
The control board consists of the microprocessor and its peripheral circuits, the drive circuits, paper end sensor and interface connector.

The power to the control board is provided from the power supply board via the connector cord. The power to the other electrical parts is distributed via the connectors in the control board.

3.1.2 Microprocessor and its peripherals circuits

(1) Microprocessor (Q8: 80C154)

The microprocessor is the nucleus of the control circuit. Its peripheral circuits operate under program control by this microprocessor. The I/O ports of the microprocessor are connected to the address bus, data bus, and control lines.

(2) Program ROM (Q12)

The program ROM contains the control program for the printer. The microprocessor operates by execution of this control program.

(3) RAM (Q1 and Q2); (Q3 and Q4) are option.

The RAM stores data such as print data which has been received.

(4) LSI (MSM6990) (Q11)

The MSM6990 is an external interface and motor control LSI. It has the following functions:

A: External interface controller

(a) Parallel interface function

The parallel interface function mode is selected when the level of the mode selection signal (ISEL) is high. In this mode, IFD1 to IFD8 are used as an input port; the parallel data received through the interface connector is latched in synchronization with the strobe signal (STB) and is sent to the CPU in synchronization with the RD signal. In this mode, the MSM6990 also sends BUSY, ACK, PE and SELECT signals to the parallel interface connector in synchronization with the WR signal.

(b) Serial interface function

The (ISEL) signal goes low and the serial interface function mode is selected only when the serial interface board is installed. In this mode, IFD1 to IFD8 are used as an input port; parallel data received from the serial interface board is sent to the CPU in synchronization with the RD signal. In this mode, the MSM6990 sends SSD, RTS, and DTR signals to the serial interface connector in synchronization with the WR signal.

(c) I/O ports

The MSM6990 (Q11) has a 12-bit output port and a 10-bit input port. It sends control signals in accordance with the commands from the microprocessor.
The input port is also used to read information from the operation panel switches, etc.

(d) Address latch

The address latch latches the low-order 8 bits of the address bus (A0 to A7). These bits are used as an address for read/write operations with peripheral devices. Latching of (A0 to A7) is necessary because these 8 bits are also used as the data bus.

8: Motor controller

(a) Spacing speed control function

This function accelerates and decelerates the spacing motor in accordance with commands from the microprocessor and controls the spacing motor speed in each printing mode.

(b) Dot timing generation function

This function generates the dot-on timing signal (IPT), synchronized with the printing speed in accordance with output signals (PHASE A, 8) of the encoder disk on the spacing motor, and sends this timing information to the microprocessor.

(5) CGROM (Q5)

The resident character fonts are stored in the character generator.

(6) EEPROM (Q9)

This 256-bit serial data electrically erasable and programmable ROM stores the menu mode data.

(7) LSI (MSM79H097) (Q6)

The MSM79H097 controls the DMA, head drive and LF microstep. The details are described below.

(a) DMA control

Data transfers from ROM to D-RAM or between D-RAMs is performed by DMA transfer eliminating the need of the CPU to perform such operations.

By setting the address of the transfer origin, the transfer destination and the number of bytes to be transferred and starting from the CPU, data in memory can be transferred directly.

(b) Head drive control

Drive pulses are produced for impact timing of the head using IPT signals as triggers. IPT signals are generated by phase A and B signals from the spacing motor.

The pulse width of this drive differs according to the number of the impact pins. Its duration can be preset by the CPU.

(c) Print data transfer control

Performs the serial transfer control of print data.
Print data will be transferred automatically from the memory area stored for decoding to the register in this LSI in synchronization with an IPT signal coming from MSM6990.

The data which is stored in the register will be transferred to the head drive unit as serial data just before the next impact timing.

(d) LF micro step control

Performs micro step control to enable fine feed of the LF motor.

(e) Memory interface

This function expands the memory space for ROMs and RAMs which are connected to this LSI, and makes it possible for the memory to access 368 Kbytes.

(f) D-RAM refresh

Performs refreshing of D-RAMs using the CAS before RAS refresh method.

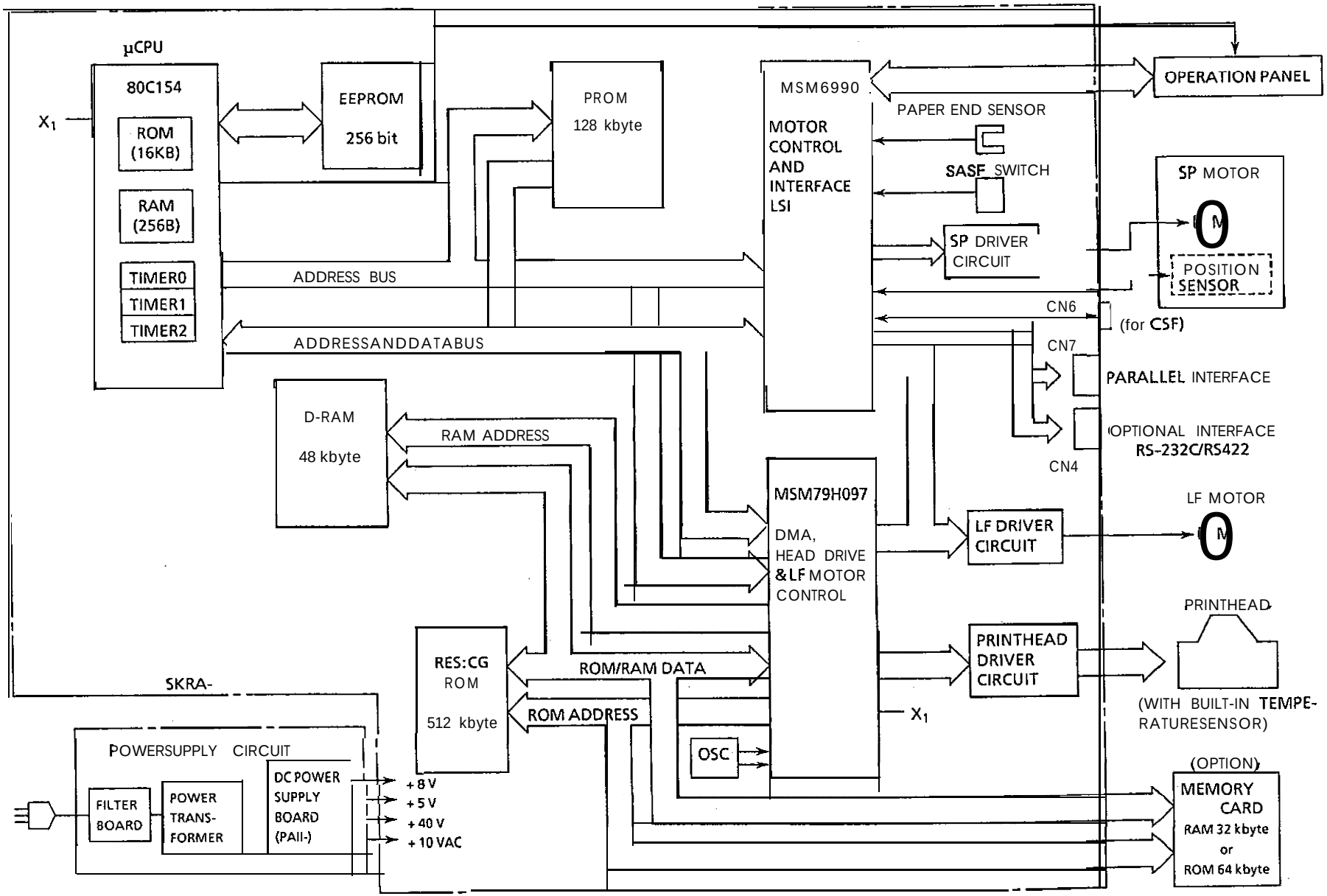


Figure 3-1 Block diagram

3.1.3 Initialization

The printer is initialized when the power is turned on or when the parallel interface signal, I-PRIME, is received from the host computer.

Initialization is started when the RST OUT 1 signal is sent from the reset circuit (Q7 pin 1) to Q11, and RST OUT-P is sent from Q11 to Q8 and Q6. BUSY signal is active during initialization stage.

When reset is completed, ROM program execution starts with mode setting of QII, Q8 and Q6. Next a memory (ROM and RAM) check is performed, RAM is initialized, and the carriage is homed. The program finally establishes the interface signals (output level of ACK signal, BUSY signal, etc.), lights the SELECT indicator, and informs the host computer that the printer is ready for data reception (in the data reception wait state), thus completing the initialization.

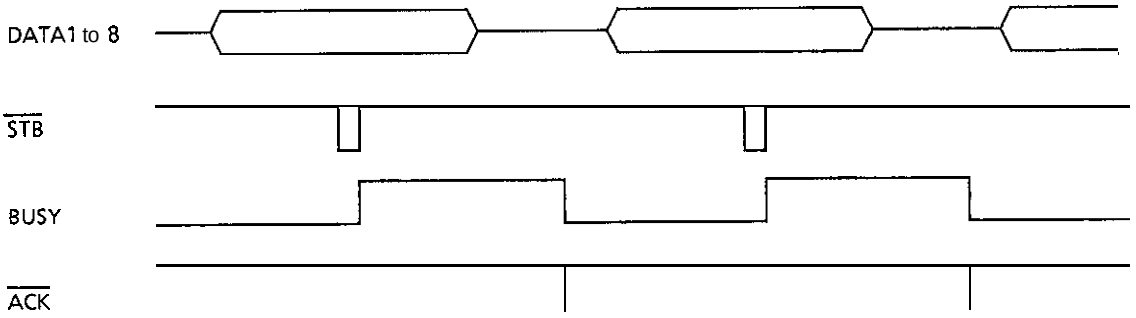
3.1.4 Interface control

(1) **Parallel interface**

The data from the interface is input through connector (CN7), and the interface LSI (Q1 1: MSM6990) latchesthis input data in sync with the ST8 signal.

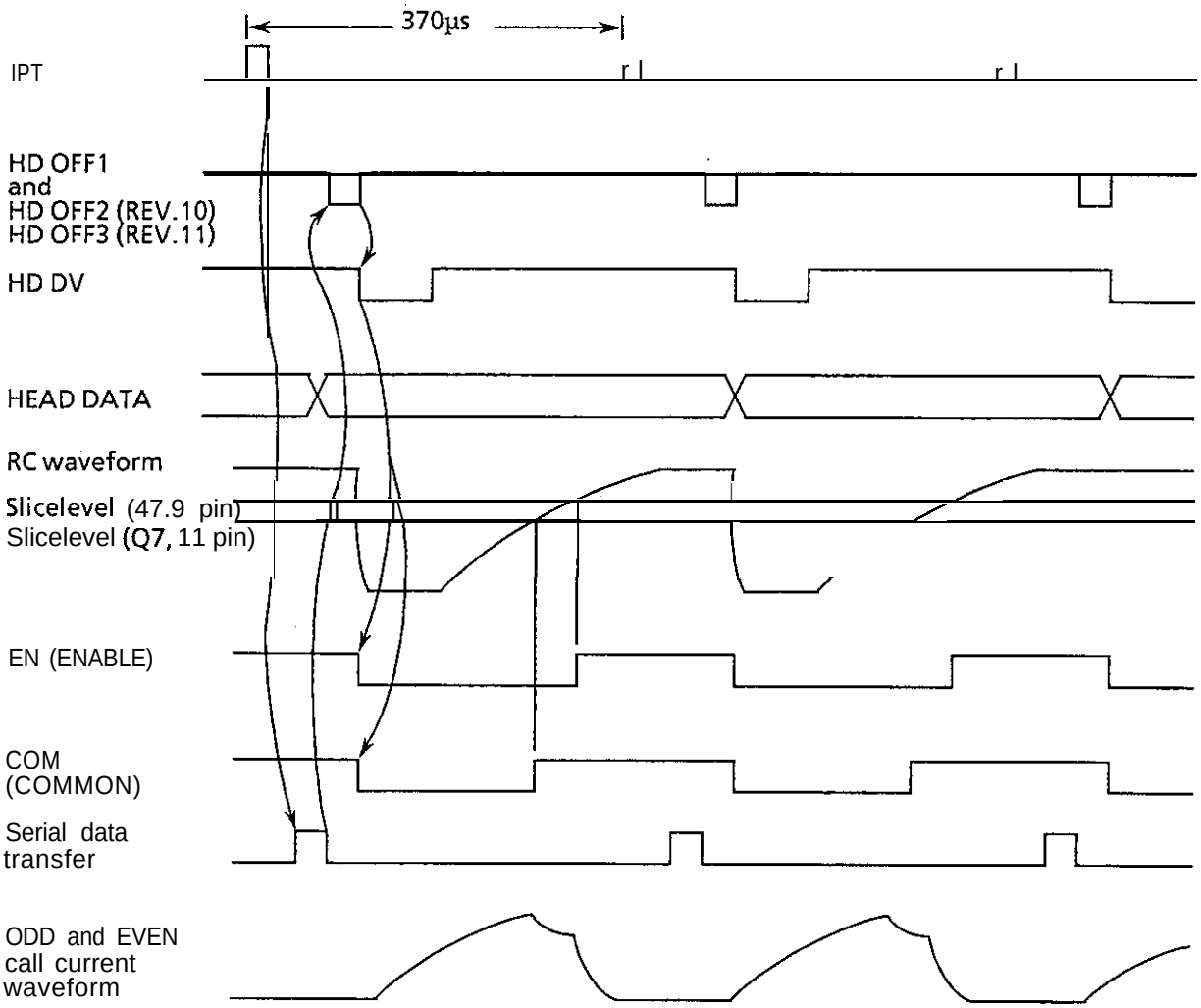
The BUSY signal is on during processing of this data. When the processing is completed, the BUSY signal is turned off, and an ACK signal is sent to request more data.

The BUSY signal is also on when data cannot be received (when the receiving buffer is full, etc).



3.1.5 Printhead drive circuit

This circuits is used to drive the head magnets corresponding to HEAD DATA 1 to 24 (the head pins) by the HD DV signal (even or odd trigger) for printing purposes. When-the HD DV signal is at "L" level, the head driving time is determined by the HD DV pulse width. This pulse is developed by a RC circuit within the IC. The pulse width of HD DV varies with the number of pins being driven. The drive time is lengthened if a larger number of pins are to be driven, but shortened if less pins are to be driven.



3.1.6 Spacing drive circuit

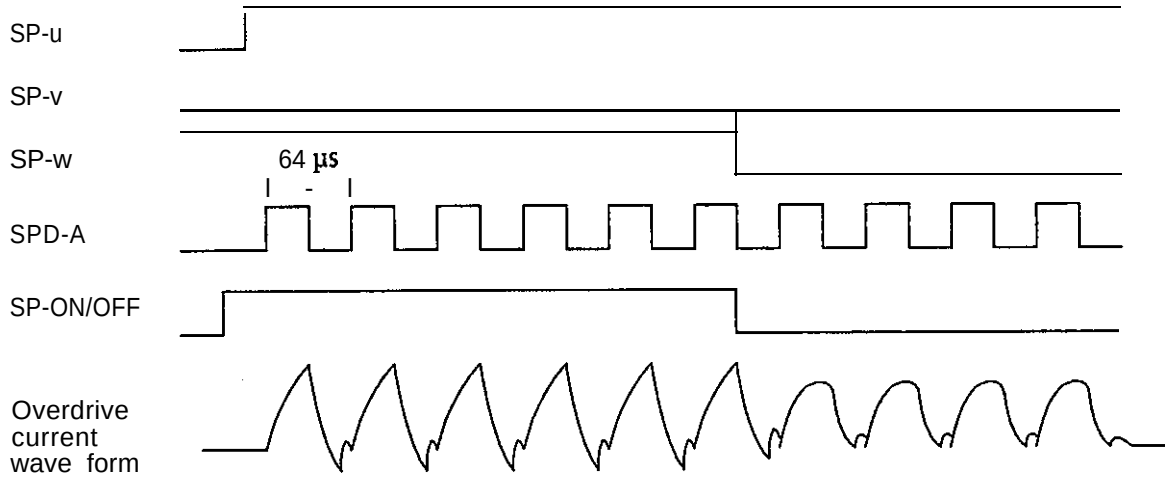
(1) Spacing motor control

The motor control LSI (Q11: MSM6990) outputs the spacing motor phase signals (SP-U, SP-V, and SP-W) in accordance with the spacing command from the microprocessor, and at the same time outputs the overdrive signal (SPD-A).

The SPD-A signal is a fixed-period pulse signal. The pulse width is controllable by the program, and is used to control the motor drive time.

The SP ON/OFF signal is used to control acceleration and deceleration motor torque.

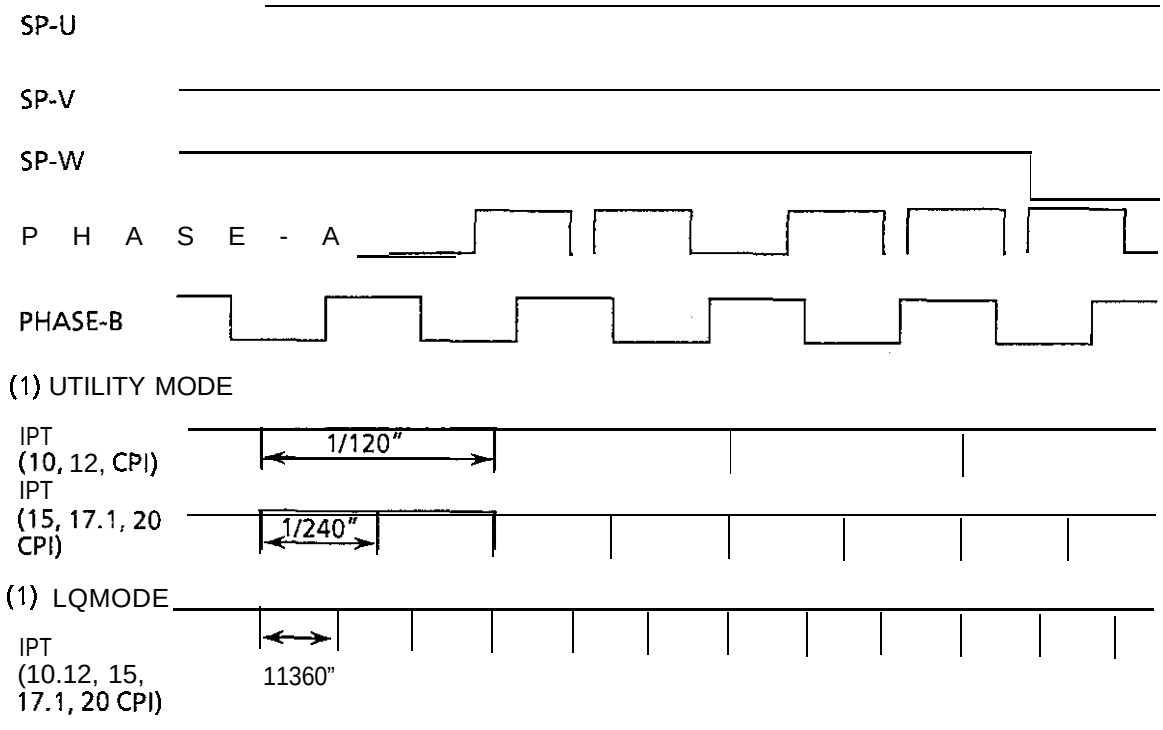
The motor driver (MTDV) drives the spacing motor in accordance with these signals. Pins 9 and 11 of the MTDV are for the protection circuits against overvoltage and overcurrent, respectively.



(2) Encoder disk

In the operation of the spacing motor, the PHASE-A and PHASE-B signals are generated. When the encoder disk interrupts the photo sensor.

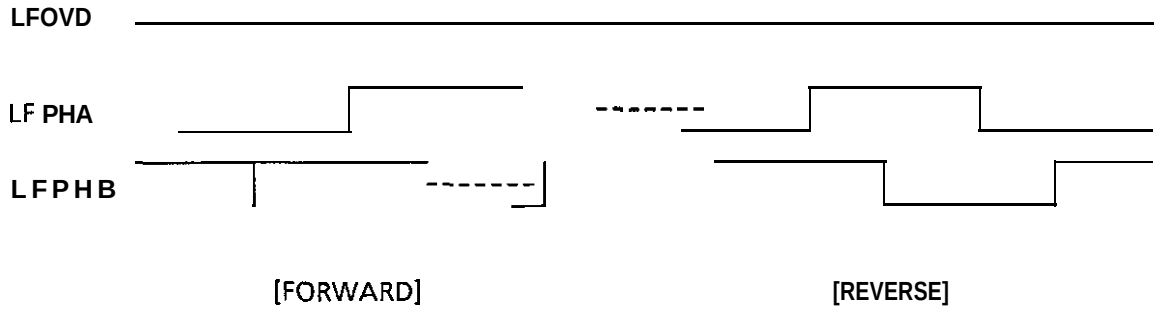
The motor control LSI (Q11: MSM6990) divides these edge pulse signals in accordance with the print pitch, and sends the IPT signal to provide dot-on timing and carriage position detection timing.



3.1.7 Line feed circuit

The line feed motor shaft is held stationary by the LF HOLD signal (holding current: approx. 25 mA) while it is at a stopped position.

During line feed operation, the line feed motor is driven by a large current supplied in accordance with LF OVD signal.



3.1.8 Alarm circuits

(1) Fault alarm circuit (in Power Supply Unit)

This is a protective circuit which causes the AC fuse to open when a fault occurs in the printhead drive circuit, space motor drive circuit, or their peripheral circuits, thus preventing component failure.

For this purpose, this circuit monitors the drive time using the HDALM and SPALM signals interlocked with the overdrive signal of each drive circuit. If the drive time of any drive circuit exceeds the specified time, the drive circuit fault alarm circuit sends an ALM signal (high) to turn on the SCR.

This causes the secondary coil (40 V) of the transformer to be short-circuited, causing an overcurrent to flow through the primary coil and making the AC fuse open.

(2) Printhead overheat alarm circuit

In order to protect the printhead coils, this circuit monitors the printhead temperature by using the thermistor which is built into the printhead.

If heavy-duty printing is performed continuously for a long time, the printhead temperature increases.

The timing and types of alarms and printing actions with respect to printhead temperature are as shown in the following.

Printing Mode	1st Alarm	2nd Alarm	3rd Alarm	Others
Bit IMAGE	3 PASS print	P.H. stop (See Note 5.)	3 PASS print	Normal print
Others (characters)	Uni-direction print	P.H. stop	Uni-direction print	Normal print

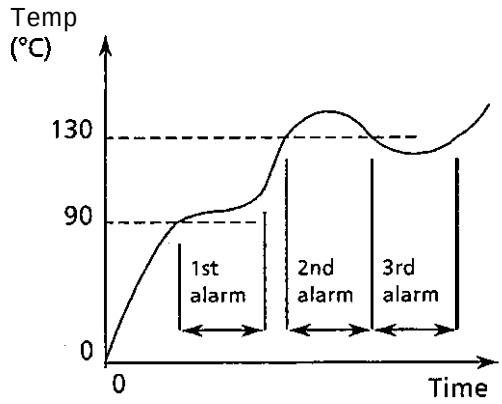
Note 1. 1st Alarm: ***For several tensseconds afterprinthead temperature has exceeded 90°C for the first time.***

Note 2. 2nd Alarm: ***For the period during which printhead temperature is higher than 130%***

Note 3. 3rd Alarm: ***For several tens seconds afterprinthead temperature fallen below 130%***

Note 4. 3 PASS Print, ***Each line is printed out being divided into three cycles --with 8 dots for each cycle.***

Note 5. When approximately20 seconds has elapsed after halting, 3 PASS printing in uni-direction starts.



Alarm detection is performed as follows:
When the temperature in the printhead increases, the resistance of the thermistor decreases and the voltage at the comparator (Q7) positive input decreases to invert the comparator output, causing the HEAD TEMP signal to be sent to the motor control LSI.

3.1.9 Paper end detection circuit

When no paper is installed or a end of paper condition exists, the photo-sensor (PE) on the control board is turned off changing the PAPER END signal to a low level. This signal is fed to pin 55 of the motor control LSI(Q11), which causes the printing operation to halt and the ALARM indicator to illuminate.

3.1.10 Power supply

The power supply consists of a power transformer, filter board, and DC power supply board.
The input AC voltage is transformed into 8.6 VAC, 46 VAC, and 10 VAC by the power transformer. These AC voltages are rectified to + 8 VDC, + 5 VDC, and + 40 VDC levels by the DC power supply board and supplied to the control board.

(1) Filter board

The filter board consists of the power switch, AC fuse and AC noise filter.

(2) Power transformer

If the internal temperature of the power transformer rises abnormally the built-in thermal fuse will open to prevent any damage to other electrical components.

(3) Power supply board

Rectifies the AC voltage input to + 8 VDC, + 5 VDC and + 40 VDC and supplies it to the control board.

3.2 Mechanical Operation

3.2.1 The printhead mechanism and its operation (See Figure 3.3.)

The printhead is a spring charged type 24-pin driving head utilizing a permanent magnet. It is attached to the carriage and moves parallel with the platen.

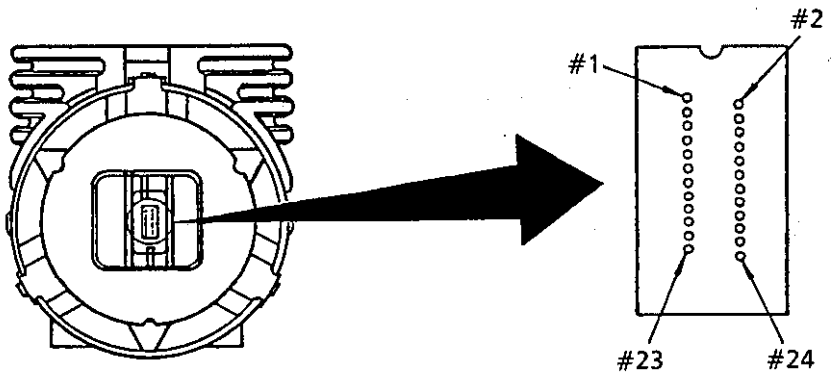


Figure 3-2 Arrangement of the head pins
(View from the tip of the printhead)

(1) The printhead is composed of the following parts:

(a) Wire guide

(b) Print wires

(c) Armature assembly

(d) Yoke

(e) Spring

(f) Spacer

(g) Magnet assembly

(h) Thermistor

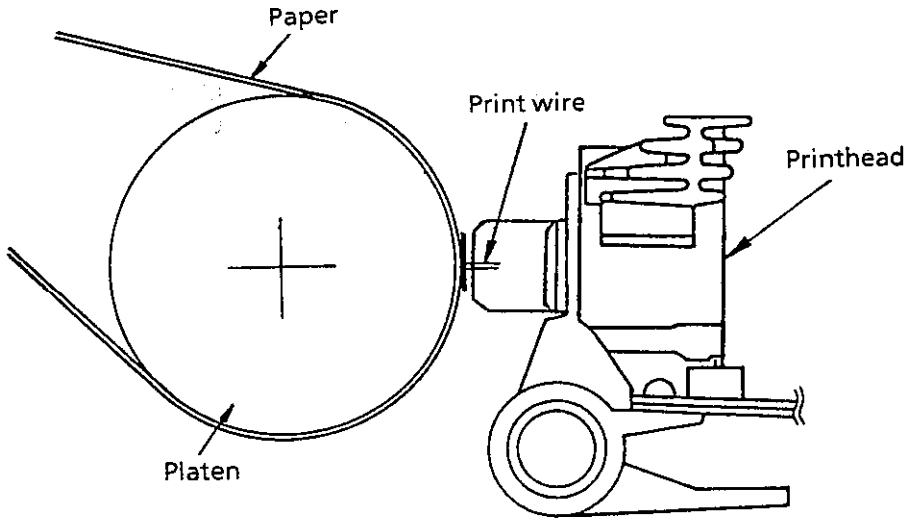
(i) Printed circuit board

(2) Operation of printhead

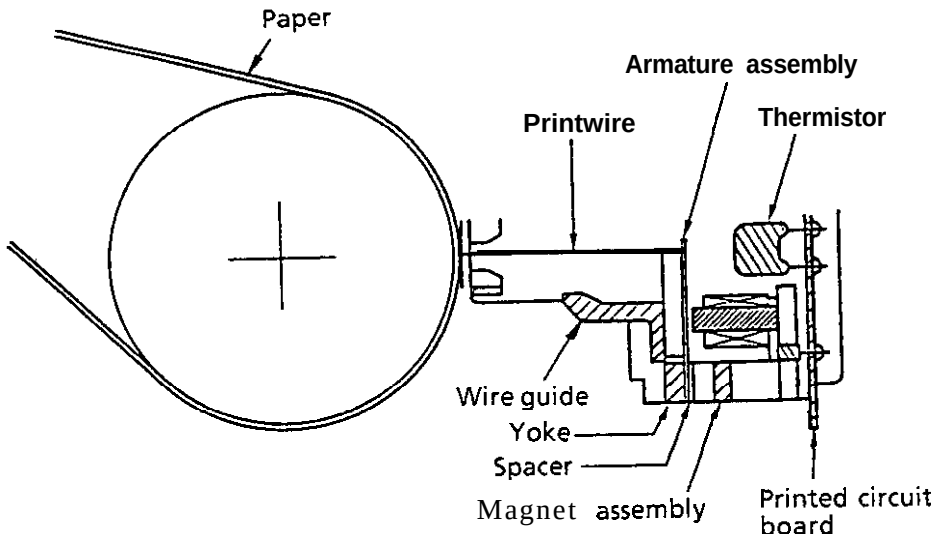
When the printhead is inactive, the armature is attracted to a permanent magnet and the spring attached to the armature is compressed. The print wires attached to each armature are thus concealed inside the wire guide.

When a signal for a character to be printed is detected, current flows through the coil. The magnetic fluxes (caused by the permanent magnet which is situated between the armature and the poles) are canceled, removing the attracting force. The armature is driven in the direction of the platen by the force of the armature spring expanding. The print wire attached to the armature protrudes from the tip of the wire guide, striking the ribbon and prints a dot on the paper.

After the character has been printed, the armature is attracted to the permanent magnet again and the print wires are concealed inside the wire guide.



(1) When printing



(2) When not printing

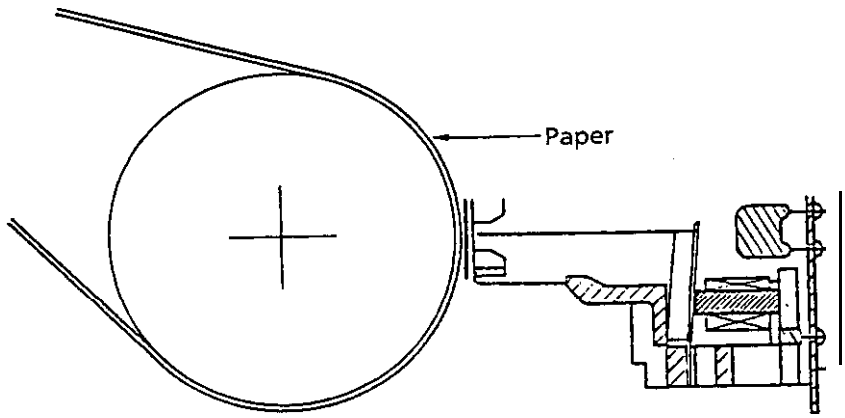


Figure 3-3

3.2.2 Spacing (See Figure 3.4.)

The spacing mechanism consists of a carriage shaft which is mounted parallel with the platen, and a carriage frame which slides over the shaft. A DC motor which is mounted on the bottom surface of the carriage frame is used to move the carriage frame. The spacing mechanism consists of the following items:

(a) DC motor with gear (motor PC board included)

(b) Carriage frame

(c) Carriage shaft

(d) Space rack

(e) Encoder sensor

(f) Encoder disk

(1) Spacing operation

The carriage frame, which is connected to the printhead and space motor, slides over the carriage shaft in parallel with the platen. When the space motor rotates in counter-clockwise direction the motor gear rotates against the space rack, moving the carriage from left to right. For every revolution of the DC motor, the carriage frame moves 0.8 of an inch (20.32 mm).

The encoder disk rotates together with the motor interrupting the encoder sensor. The position of the carriage frame can be determined by counting the number of times the encoder sensor has been interrupted.

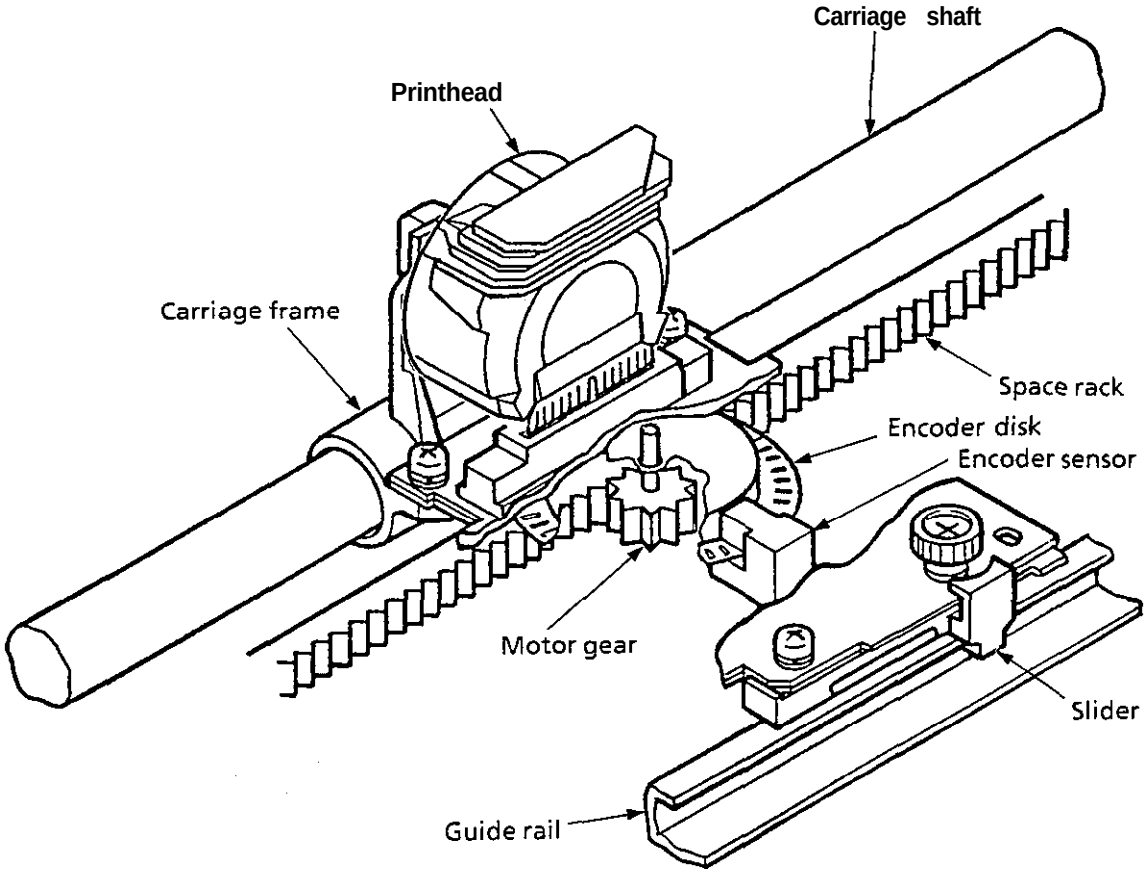


Figure 3-4

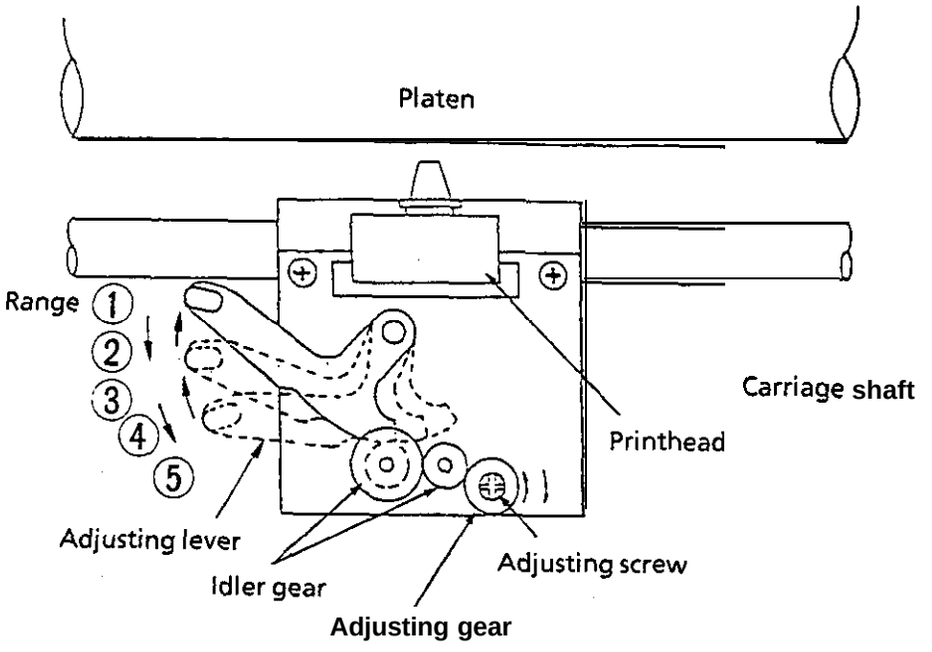
3.2.3 Head gap adjusting (See Figure 3-5.)

The head gap adjusting lever moves back and forth to tilt the carriage frame, altering the gap between the printhead and the platen.

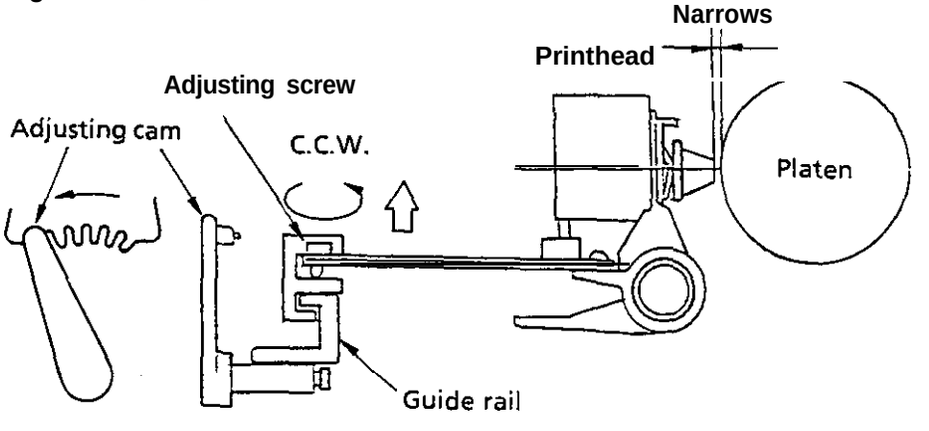
The adjusting screw, which is connected to the adjusting gear rotates when the adjusting lever is moved creating a fine gap adjustment. If the adjusting gear is pushed down, the adjusting screw can be turned with a screw driver to change the coarse gap adjustment.

When the adjusting lever is set to range ⑤, the contact which is attached to the under side of the carriage cover will connect with the contact of the space motor PC board. The printer will reduce the printing speed automatically to ensure that adequate printing pressure is maintained for multipart paper.

And, the adjusting cam adjusts the headgap toward left and right side in accordance with the guide rail up and down as a position of the left end of it.



Range from ① to ⑤



Range from ① to ⑤

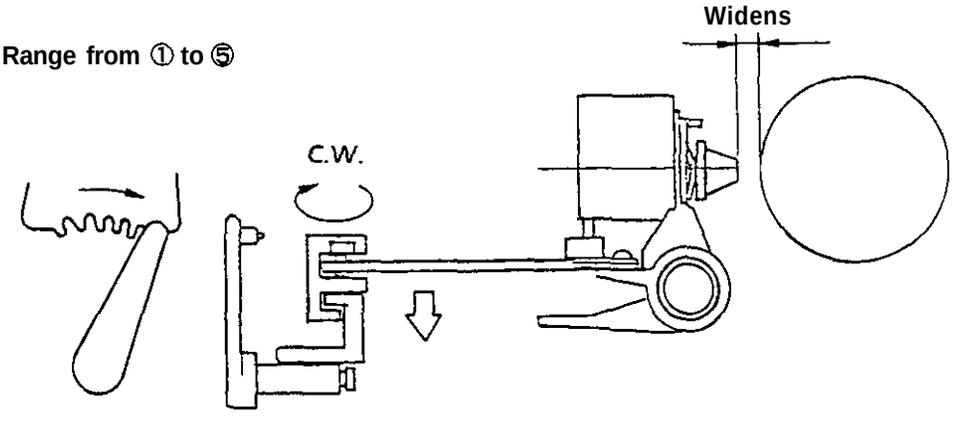


Figure 3-5

3.2.4 Ribbon drive (See Figure 3-6.)

The ribbon driver mechanism moves the ribbon in synchronization with the space motor operation.

The ribbon drive mechanism consists of the following items:

(a) Ribbon drive gear assembly

(b) Ribbon gear (space motor)

(c) Ribbon cartridge

(1) Ribbon cartridge

An endless ribbon with a single direction feed is used. Ink is supplied from an ink tank, which is built in to the ribbon cartridge.

(2) Ribbon feed operation

When the space motor is activated, the ribbon gear rotates. The rotation is transmitted via the ribbon drive gear assembly to the drive gear in the ribbon cartridge, thus moving the ribbon.

The feed direction of the ribbon is maintained by switching the rotational direction of the gears in the ribbon drive gear assembly. This ensures ribbon movement when bidirectional printing is used.

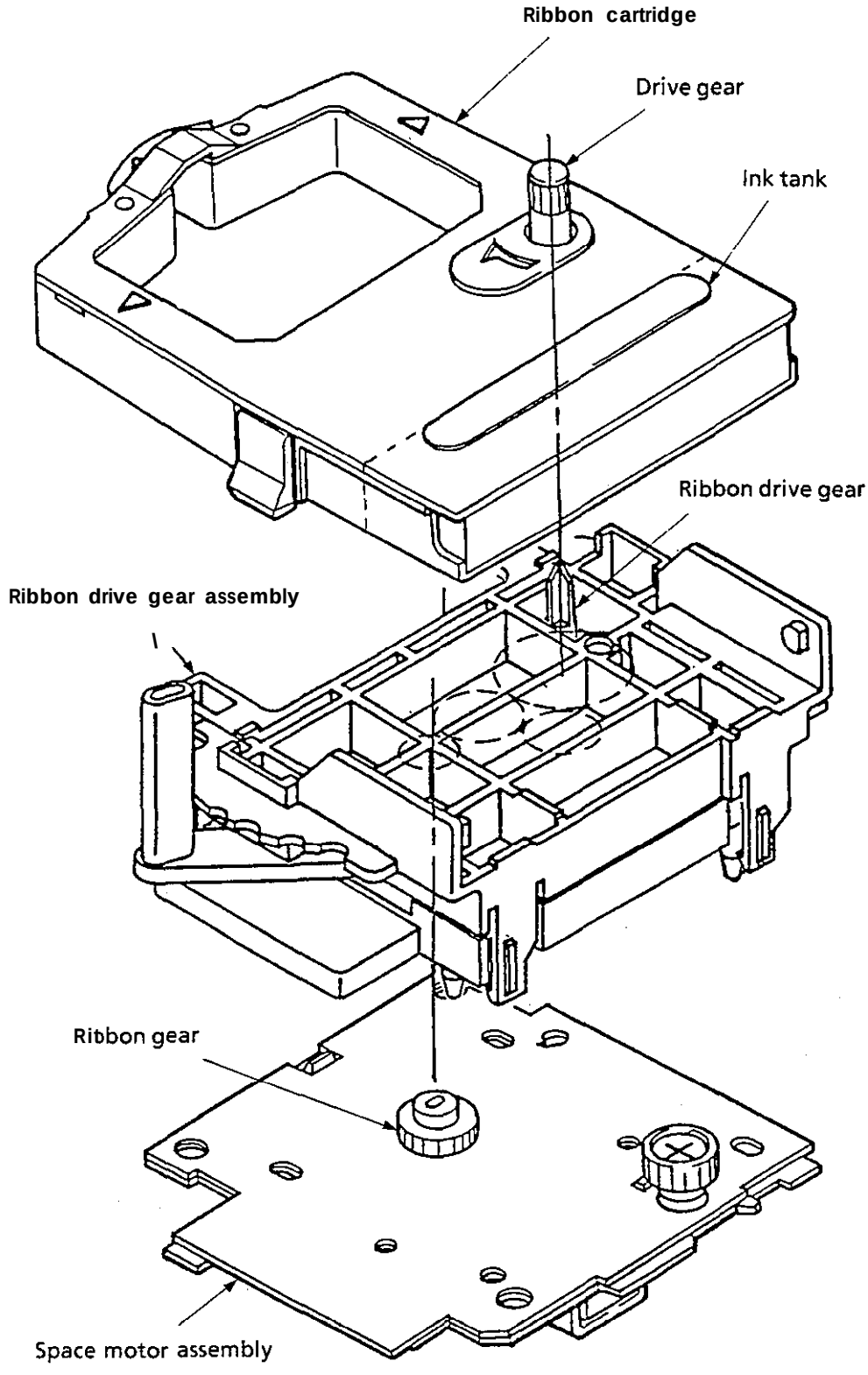

Ribbon cartridge
Drive gear
Ink tank
Ribbon drive gear
Ribbon drive gear assembly
Ribbon gear
Space motor assembly

Figure 3-6

3.2.5 Paper feed

Paper feeding is performed by turning the platen and the pin tractor, which is driven by the LF pulse motor.

The paper feed mechanism consists of the following items:

(a) **Pulse *motor* with gears**

(b) **Decelerating gear**

(c) **Platen**

(d) **Tractor feed unit**

(e) **Pressure roller**

(1) **Cut-sheet feed operation (See Figure 3-7.)**

The pulse motor used for the paper feed mechanism is mounted on the left side of the printer frame, and the rotation of the motor is transmitted through decelerating gears (idler gear, platen gear) to the platen. The rotation of the platen is also transmitted to the tractor unit via a transmission gear.

It is designed in such a way that if the stepping motor rotates 48 steps (360°), paper is fed 1/6 inch (4.23 mm).

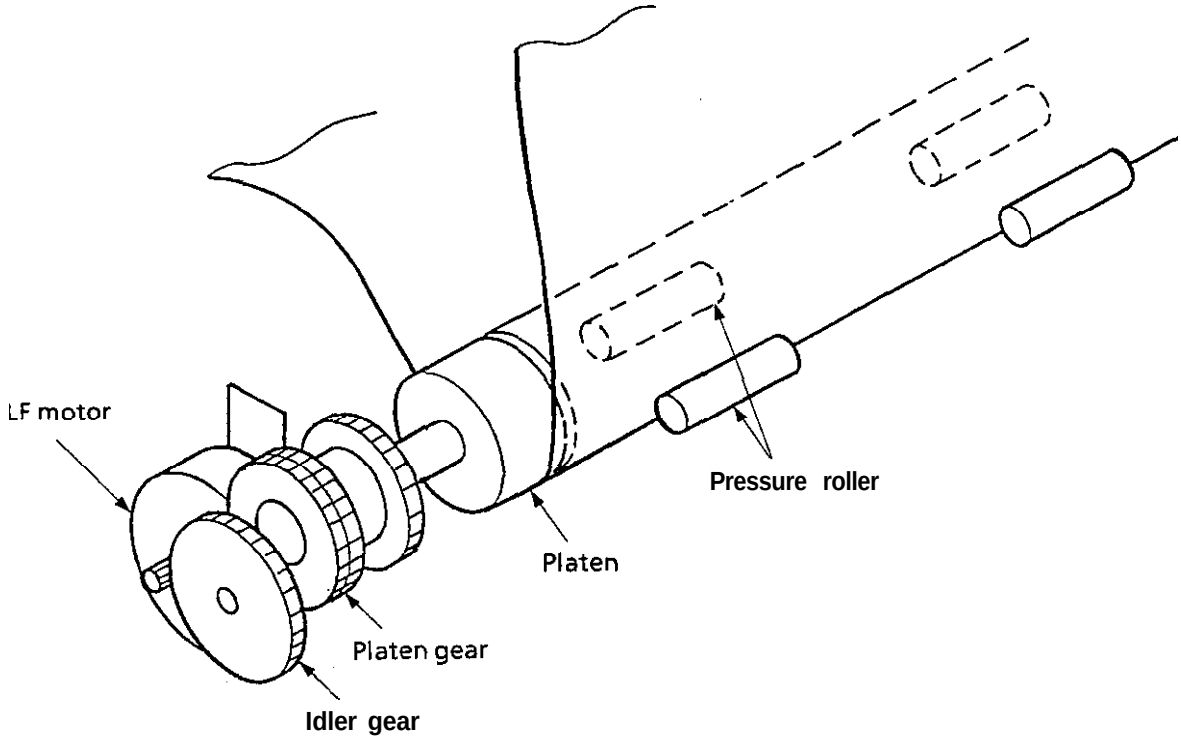


Figure 3-7

(2) **Continuous paper feed operation (See Figure 3-8.)**

The force transmitted to the platen, as explained in Paragraph (1) for cut sheet feed operation, rotates tractor gear B through platen gear A, the idler gear and the change gear. The rotation of tractor gear 8 makes the pin tractor belt rotate through a sheet feeder'shaft, feeding the continuous paper.

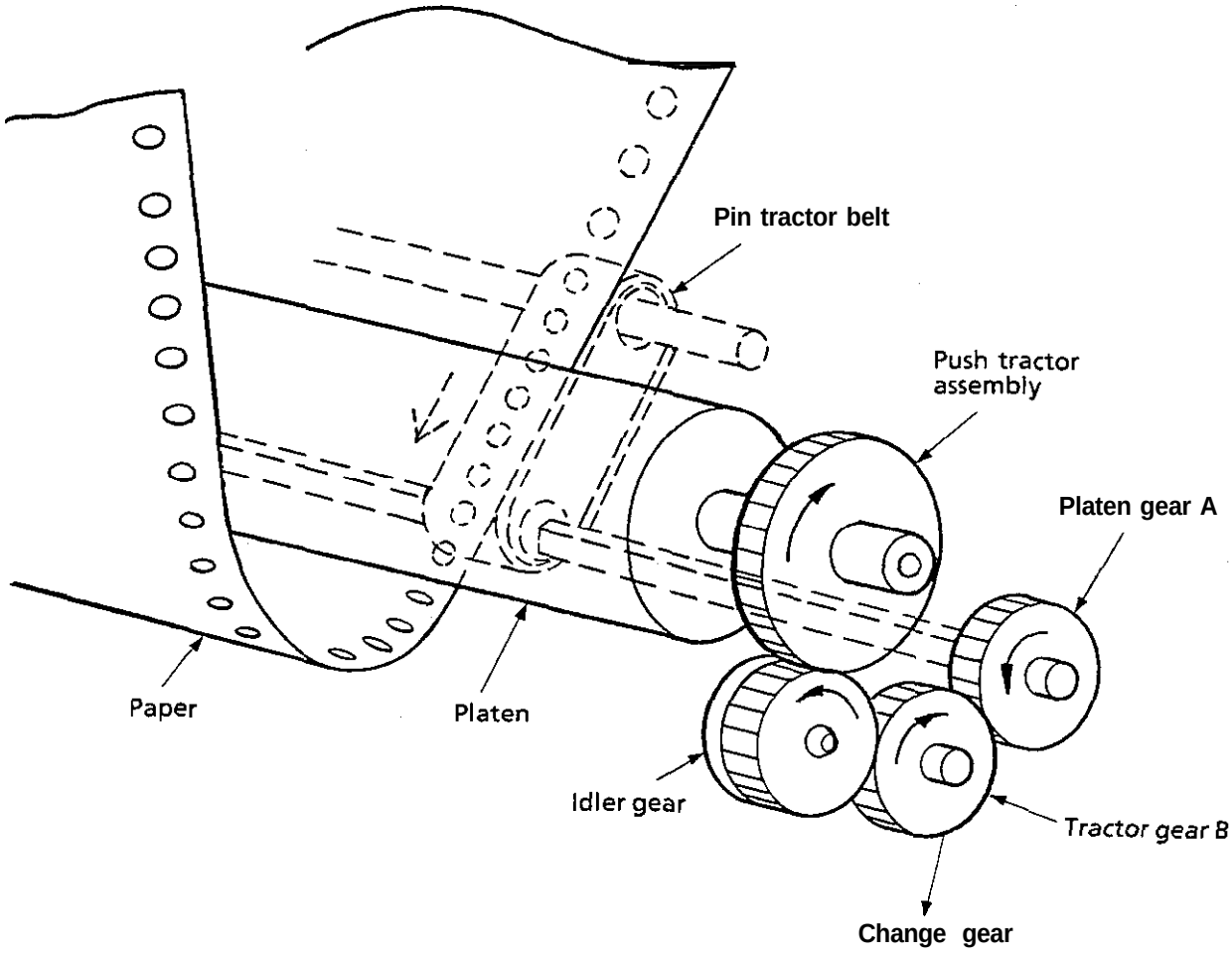


Figure 3-8 Paper feed **operation for continuous paper**

(3) Cut-sheet and continuous sheet switching mechanism (See Figure 3-9.)

The selection of cut-sheet and continuous sheet is done by using the release lever on the right side of the printer mechanism.

When the release lever is pushed back, the change gear is moved outward in the direction of the arrow. As the power transmission from the idler gear to tractor gear is removed, the pin tractor becomes inoperative.

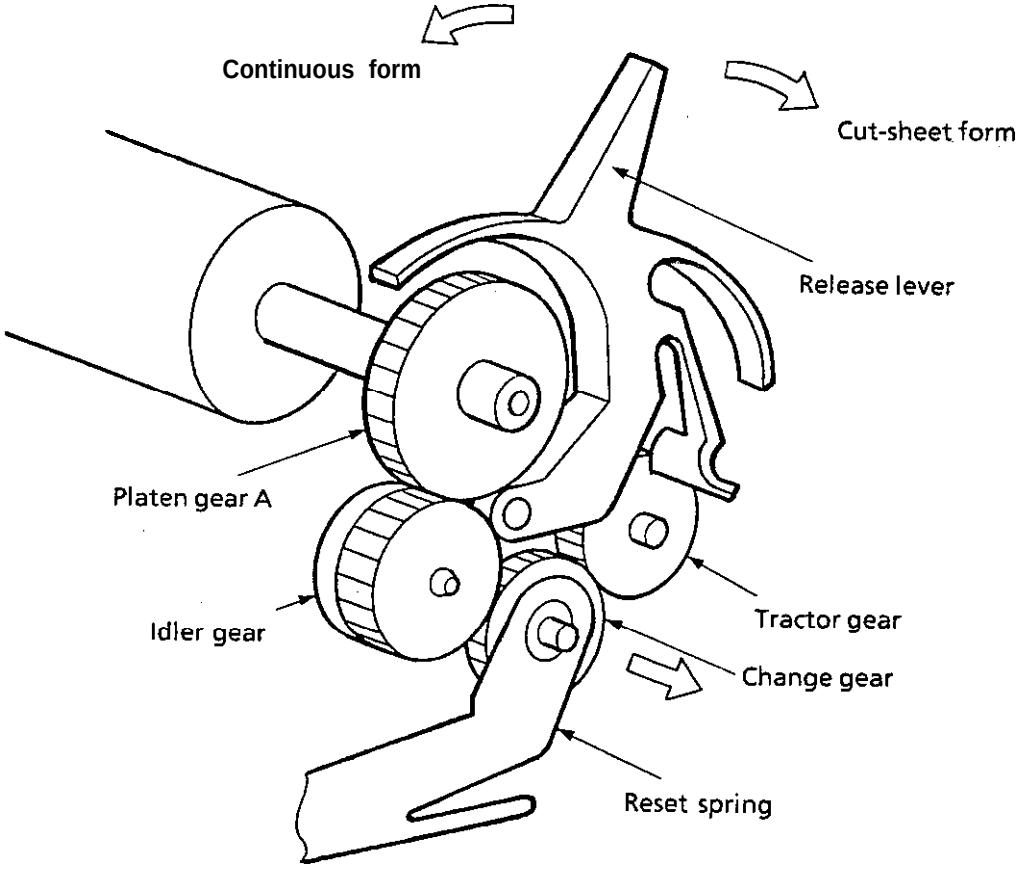


Figure 3-9

Cut-sheets are fed by the rotation of the platen, but continuous sheets are not. When the release lever is pulled forward, the change gear moves inward, opposite of the arrow because the change gear is pressed against the reset spring. The rotation of the idler gear is then transmitted to the tractor gear and continuous sheets can be fed.

(4) **Pull tractor mechanism (option) (See Figure 3-10.)**

Bottom feed of continuous sheets is possible only when an optional tractor unit is installed.

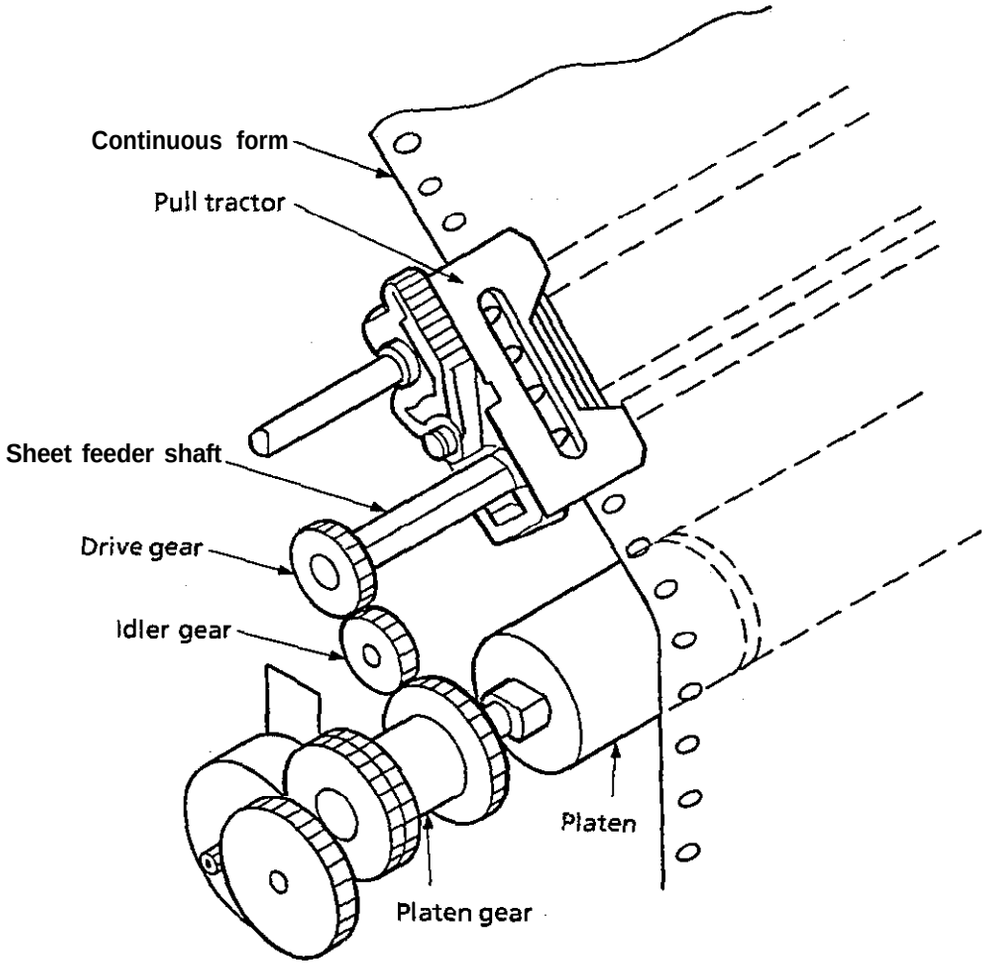


Figure 3-10

The rotation of the platen is transmitted to the idler gear of the pull tractor unit through the platen gear at the left end of the platen. The rotation of the idler gear is transmitted to the drive gear, and continuous forms are fed by the pull tractor being rotated by the sheet feeder shaft.

(5) Push and pull tractor mechanism (option) (See Figure 3-11.)

This mechanism consists of an optional pull tractor and a standard push tractor mechanism. This mechanism can perform forward and reverse feed by setting continuous sheets to the push tractor and pull tractor.

The rotation of the platen is transmitted to the push tractor and the pull tractor. Sheets are fed by these two tractors at the same time.

To remove slack from the sheets, set the sheets according to the following procedure when using the push and pull tractors.

1) **Set the release lever to the continuous sheet side (setting the sheets to the push tractor to feed).**
2) **Set the paper, which is fed in front of the platen, to the pull tractor.**
3) **Set the release lever to the cut-sheet side and feed paper using the platen knob.**
4) **If paper slack is removed, set the release lever to the continuous sheet side.**

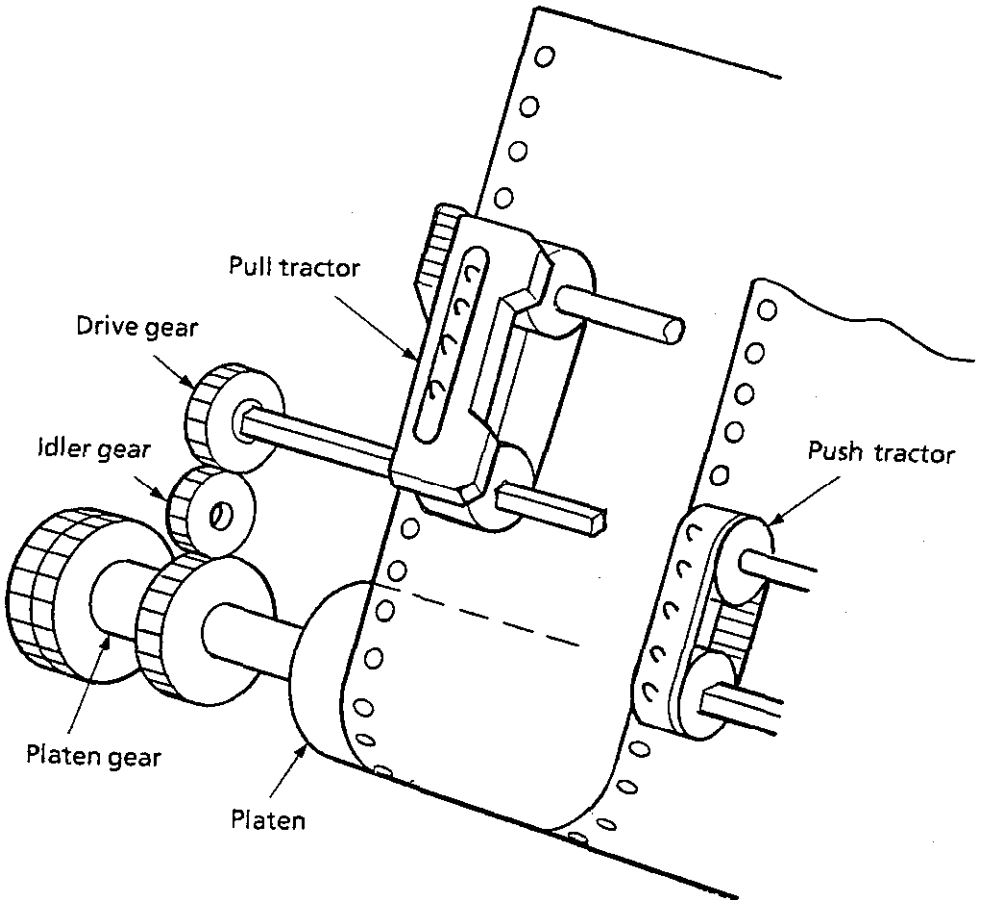


Figure 3-11

(6) Paper clamp mechanism (See Figure 3-12.)

When the release lever is pushed to the open position, the release link rotates in a counter-clockwise direction. The release shaft, which is engaged with this, rotates in a counter-clockwise direction at the same time. A clearance is created between the pressure roller and the platen through which sheets can be inserted.

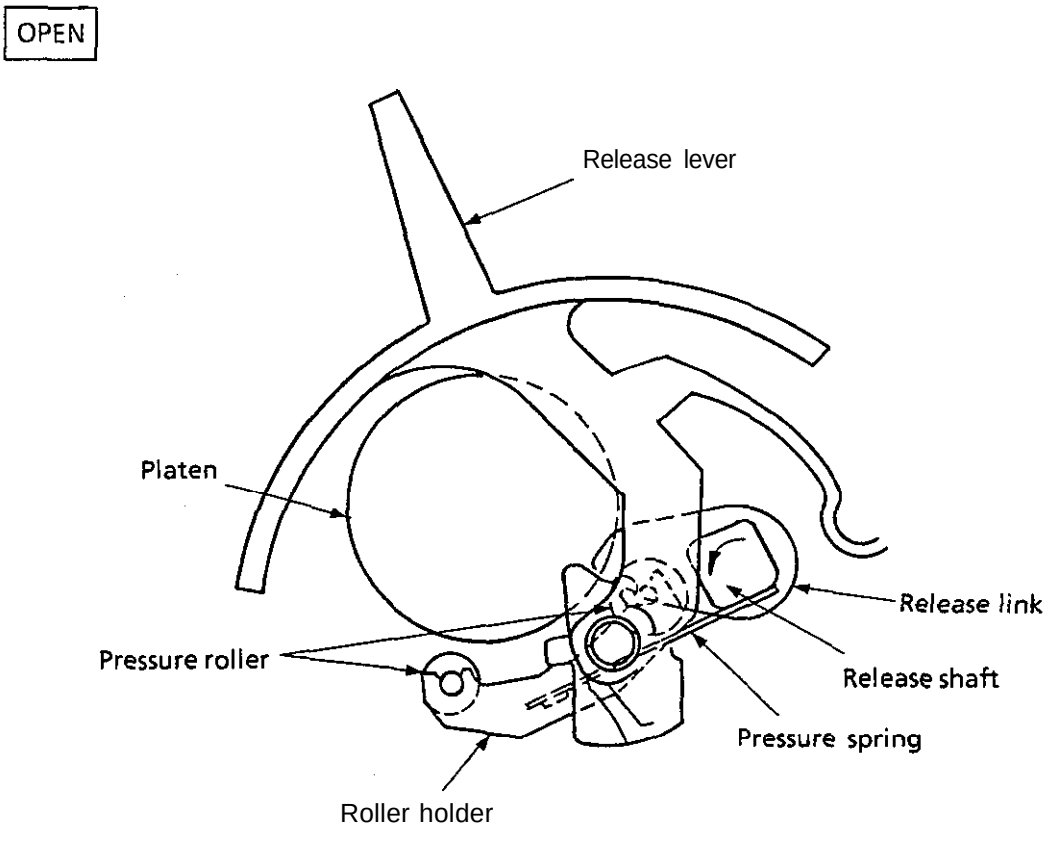


Figure 3-12 (a)

Conversely, if the release lever is pushed in a closed position, the release link rotates in a clockwise direction. The release shaft, which is engaged with this, rotates clockwise at the same time. The pressure roller is pressed against the platen by the pressure spring which is welded to the release shaft, thus feeding is enabled.

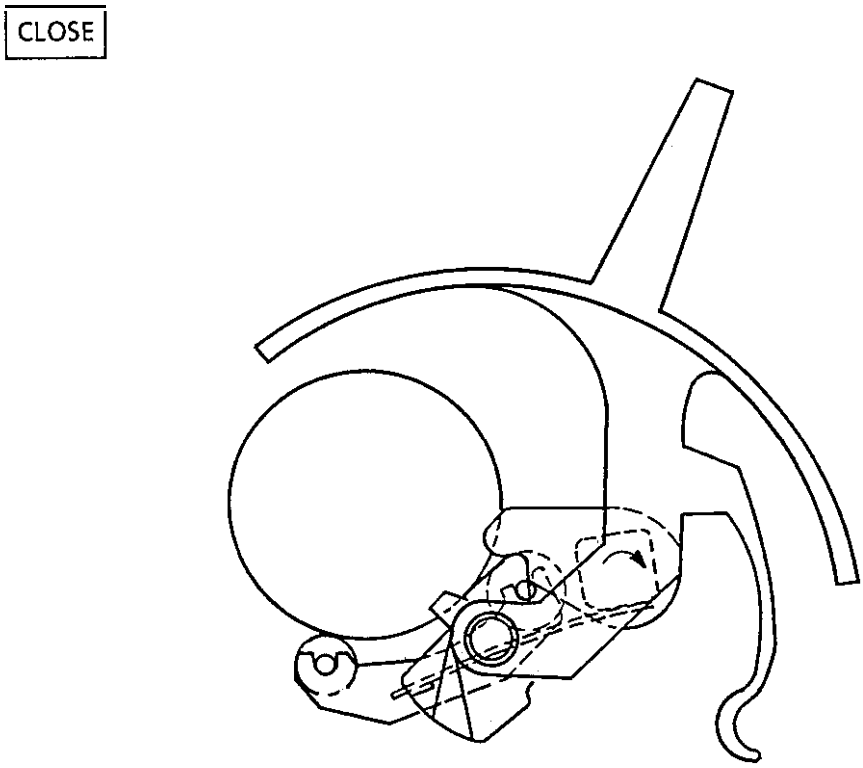


Figure 3-12 (b)

3.2.6 Paper end detection (See Figure 3-13.)

(1) Paper end for rear feed paper

When a sheet is inserted, tip A of the paper end lever B is prevented, by the paper, from falling into the slot of the paper chute. The sensor lever is pushed up by pressure ⓐ, and the paper end sensor is turned on. If the paper is removed, tip A of the paper end lever B falls into the slot of the paper chute. At the same time the rear part of the sensor lever interrupts the sensor, turning it off, detecting a paper end. The paper end is detected with about 1 inch (25.4 mm) of paper remaining from the print position.

(2) Paper end for bottom feed paper

When a sheet is inserted, the tip B of the paper end lever B is prevented from failing into the slot of a bottom paper guide, the sensor lever is pushed up by the pressure ⓑ and the paper end sensor is turned on. If the paper is removed, the tip B of the paper end lever B falls into the slot of the bottom paper guide. At the same time the rear part of the sensor lever interrupts the sensor, turning it off detecting a paper end. The paper end is detected with about 1 inch (25.4 mm) of remaining paper from the print position.

(3) Cut-sheet end

When a sheet is inserted, the paper prevents the tip of the paper end lever from falling into the slot of the platen. The sensor lever is pushed up by pressure ⓒ, and the sensor is turned on.

If the sheet is removed, the paper end lever falls into the slot of the platen, the rear part interrupting the sensor at the same time, turning it off and detecting a paper end. The paper end is detected with about 1 inch (25.4 mm) of the sheet remaining from the print position.

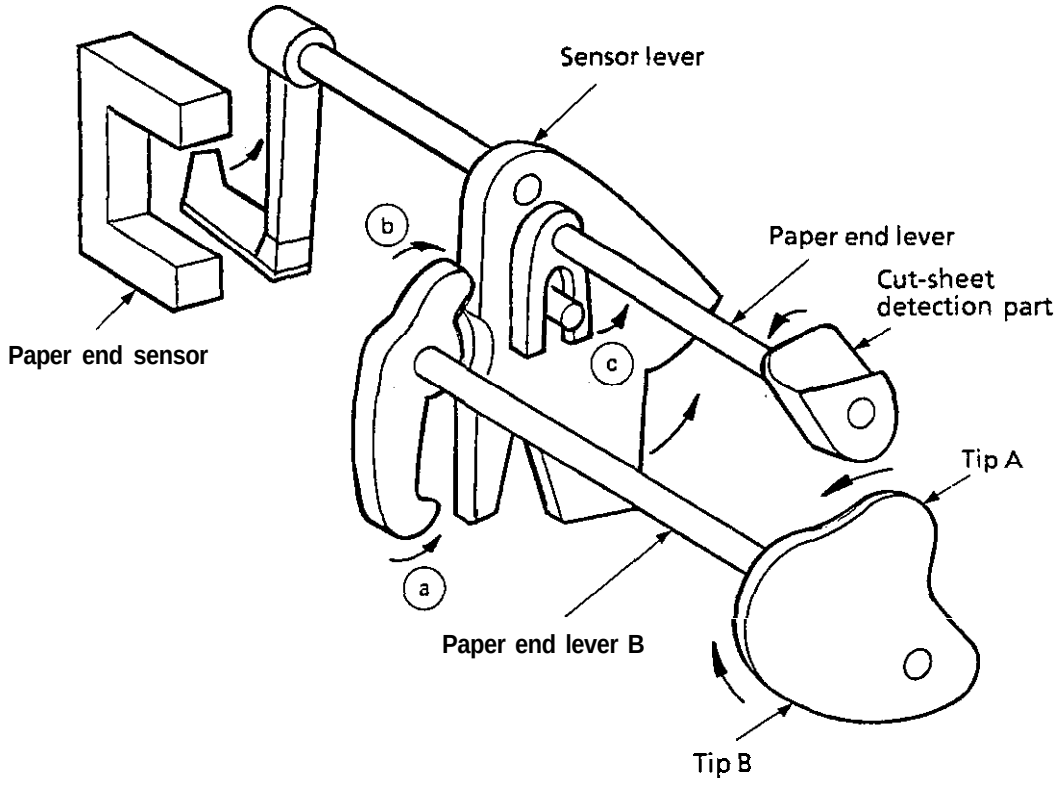


Figure 3-13

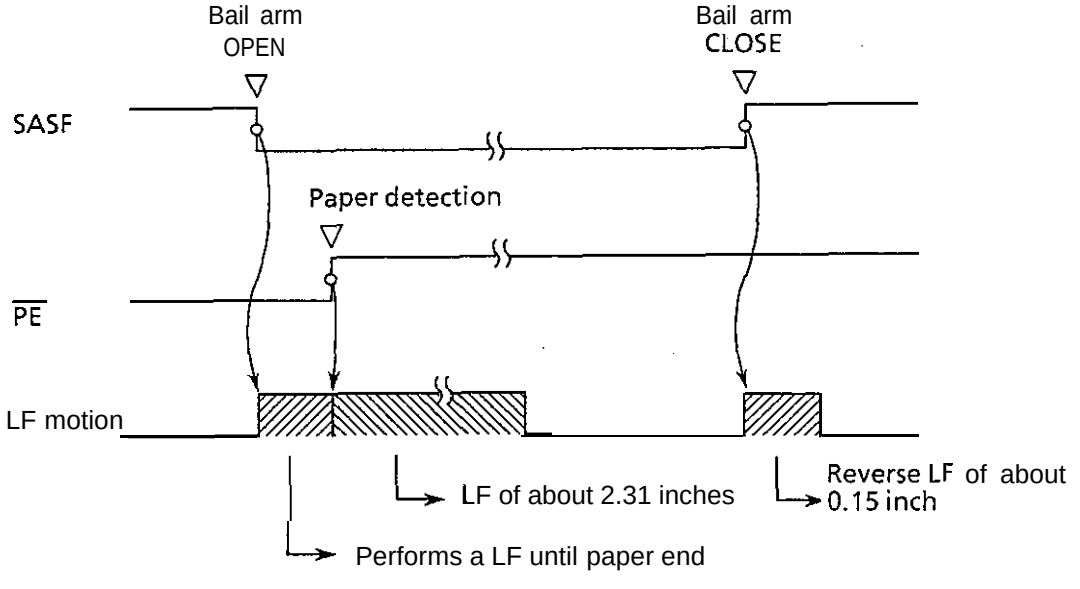
3.2.7 Semi-automatic sheet feeder (SASF) (See Figure 3-14.)

This function sets the print start position of the paper automatically when using cut-sheet and continuous sheet paper.

The procedural operation is as follows:

(1) When using a cut-sheet (SASF)

1) Set the release lever to the cut-sheet side (rear side).
2) Insert paper **from** behind the platen.
3) Pull the bail arm forward to set it to the open state, causing the SASF switch to be turned on.
4) LF operation is started and paper will be fed to the print position.
5) About 2.31 inches of a sheet is fed.
6) If the bail arm is returned to the original position, a reverse LF of about 0.15 inch is performed.



When the bail arm is open, the LF motor is driven to feed 3 inches of paper. When the LF motor drive has finished this, and if a sheet has not been fed, the SASF motion becomes invalid and is handled as an ordinary paper end.

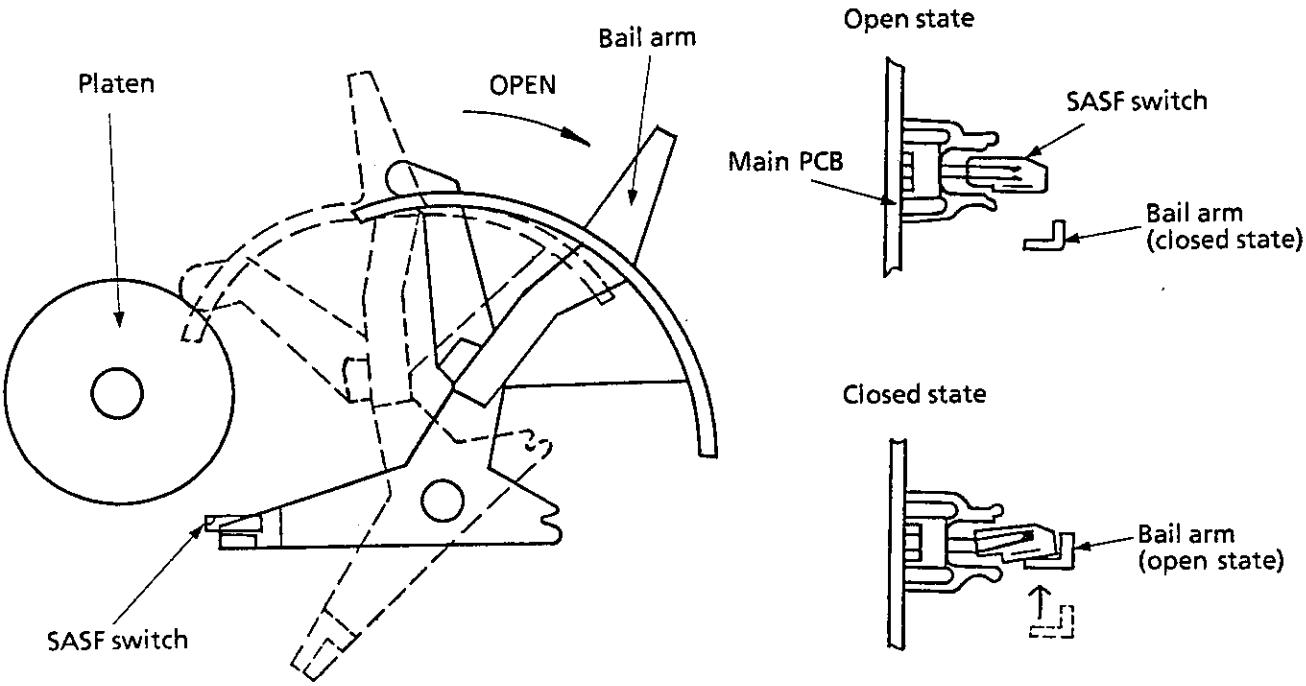
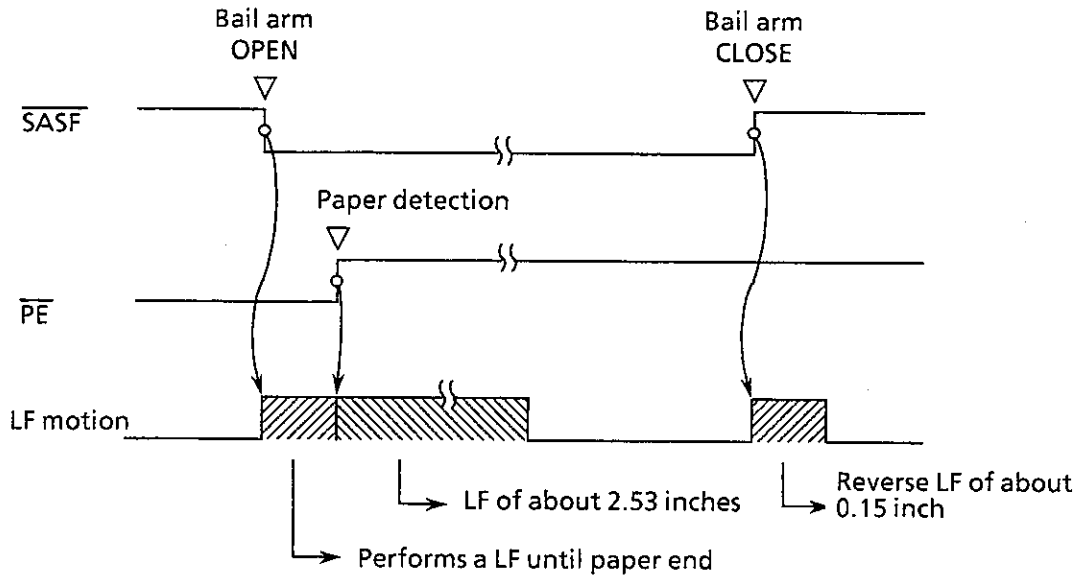


Figure 3-14

(2) **When using continuous sheets (rear feed) (Auto Load)**

1) Set the release lever to the continuous sheet side.
2) Insert the paper in the push tractor.
3) Pull the bail arm forward to the open state, turning on the SASF switch.
4) The LF action is started, and sheet will be fed to the print position.
5) About 2.53 inches of a sheet is fed.
6) When the bail arm is returned to the original position, a reverse LF of about 0.15 inch is performed. The position is about one inch from the top of a sheet for the print start line.



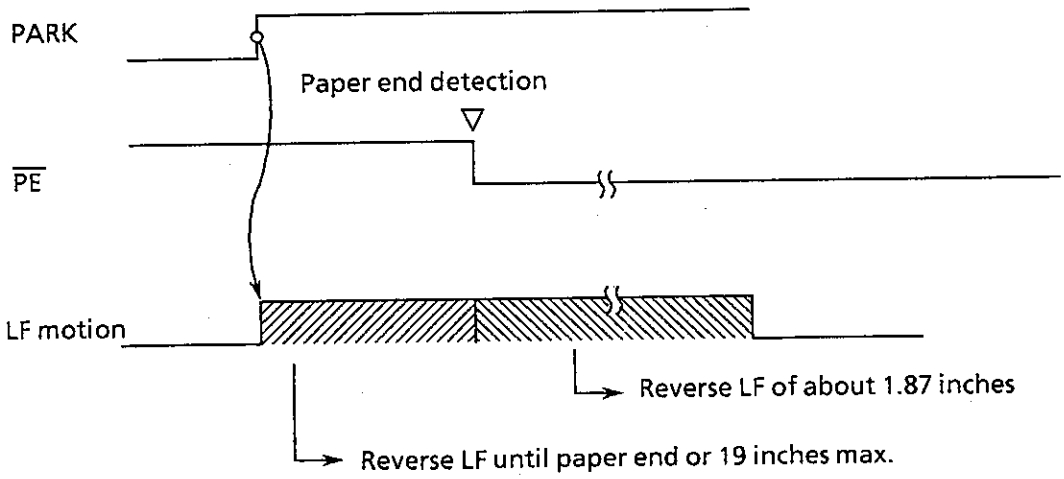
When the bail arm is open, the LF motor is driven to feed 2 inches of paper. When the LF motor drive has finished this, and if a sheet has not been fed, the SASF action becomes invalid and is handled as an ordinary paper end.

3.2.8 Reversing continuous sheets

Continuous sheets which have been inserted can be reversed automatically by using the park button on the operation panel.

Its operation is as follows:

1) Press the park button on the operation panel.
2) Reverse LF is started and sheet is fed reversely until paper end occurs or 19 inches maximum.
3) Then about 1.87 inches of the sheet is fed reversely, leaving the sheet on the push tractor only.



4. ASSEMBLY/DISASSEMBLY

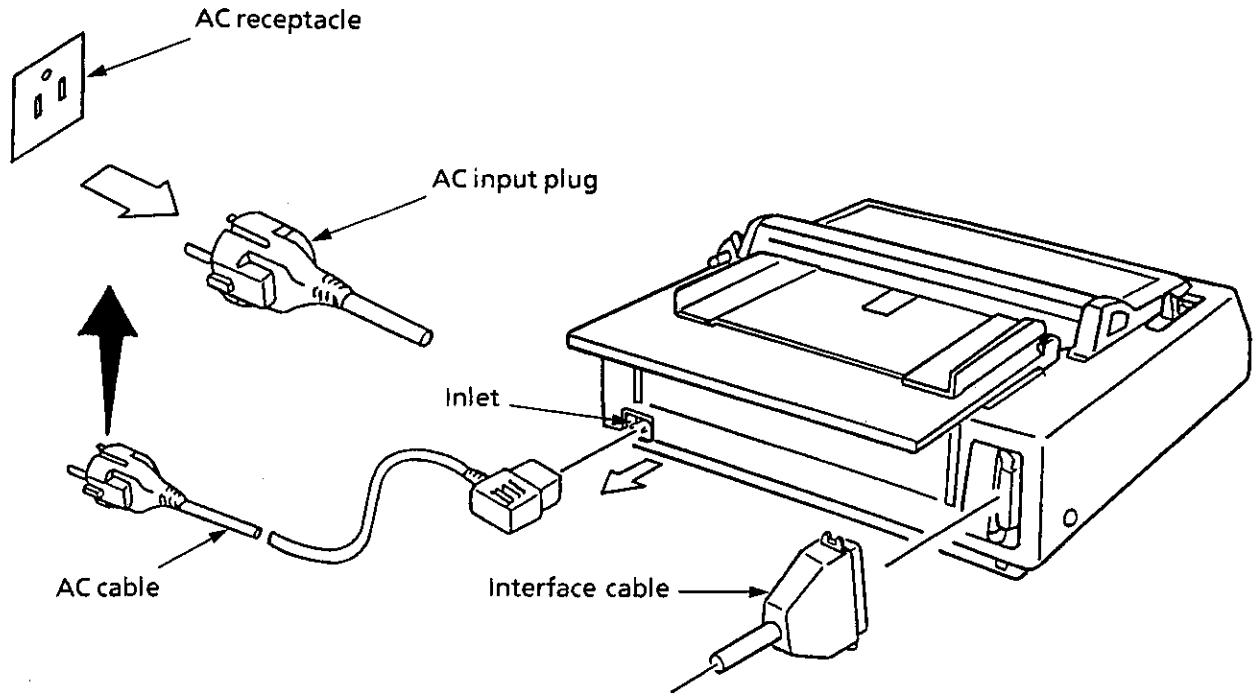
4. ASSEMBLY/DISASSEMBLY

4.1 Precautions for Parts Replacement

(1) Disconnect the AC cable and interface cable before assembling or disassembling the printer.

(a) Turn off the AC power switch. Disconnect the AC input plug of the AC cable from the AC receptacle, then disconnect the AC cable from the printer inlet.

(b) To reconnect the AC cable, first connect the AC cable to the printer inlet, then connect to the AC receptacle.



(2) Do not disassemble the printer as long as it is in good operating condition.

(3) Be careful not to remove parts unless necessary. Disassembly should be the minimum necessary.

(4) Use only the specified maintenance tools.

(5) Disassemble the printer in the specified order of disassembly procedures.

(6) ICs such as the microprocessor, ROM, and RAM can easily be damaged by static electricity. Do not wear any items of clothing that are apt to produce static electricity when handling printed-circuit boards.

(7) Do not place the printed-circuit boards directly on the printer or the floor.

4.2 Maintenance Tools

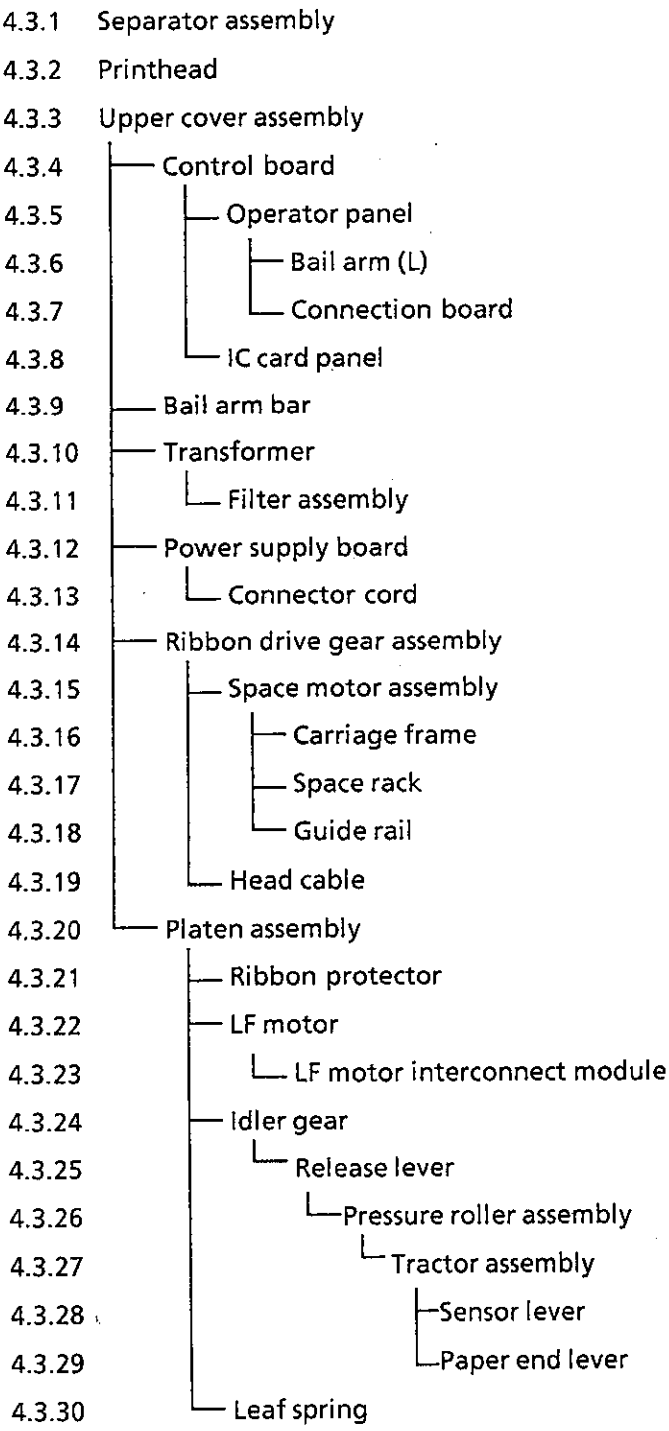
The tools which are required to replace printed circuit boards and other parts in the field are shown in Table 4-1. Tools other than those mentioned below may become necessary for the other maintenance procedures.

Table 4-1 Maintenance tools

No.	Maintenance tool	Quantity	Purpose of tool	Remarks
1	Screwdriver Set	1		
2	Round pliers No.1	1		
3	Thickness gauge set	1	for head gap adjustment	
4	Volt-ohm-milliammeter	1		

4.3 Disassembly/Reassembly of Procedure

Explained in this section are the methods for removing and reinstalling the assemblies shown in the following disassembly diagram. The procedures explained apply to removing the assemblies. Reverse the procedures, in principle, when reinstalling the assemblies.

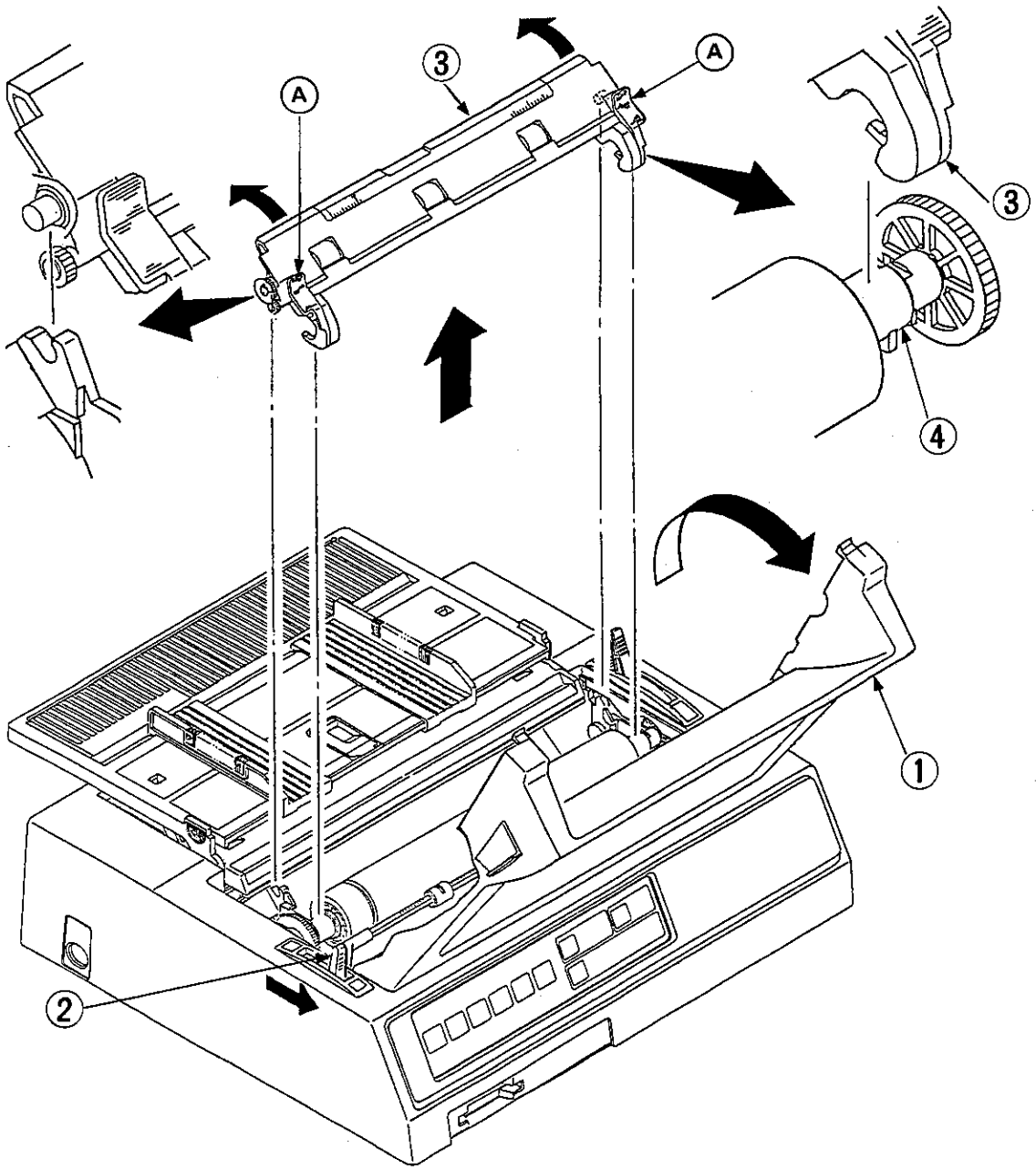


4.3.1 Separator assembly

(1) Open access cover ① .

(2) Move bail lever forward.

(3) Tilt separator assembly ③ backward by lock lever Ⓐ to release it from the platen assembly shaft ④.



4.3.2 Printhead

(1) Open the access cover ①.

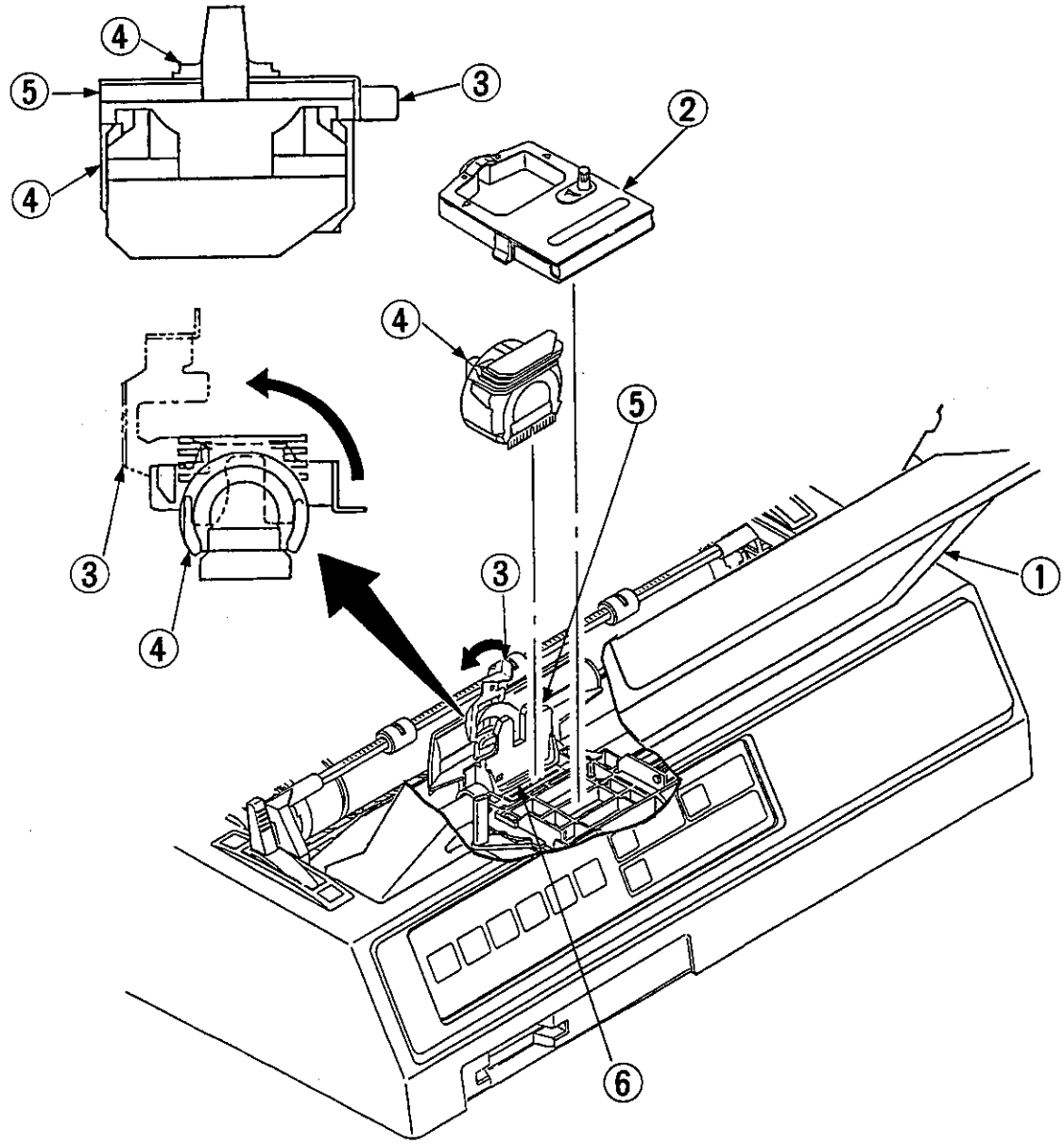
(2) Remove the ribbon cassette ②.

(3) Move the head clamp ③ 90° to the left to unlock the printhead ④.

(4) Remove the printhead ④ from the carriage frame ⑤.

[Notes on installation]

1. *Push the printhead ④ down into the connector ⑥ while guiding it into the carriage frame ⑤.*
2. *Position the head clamp ③ securely between the printhead ④ and the carriage frame ⑤.*



4.3.3 Upper cover assembly

(1) Remove the platen knob ①.

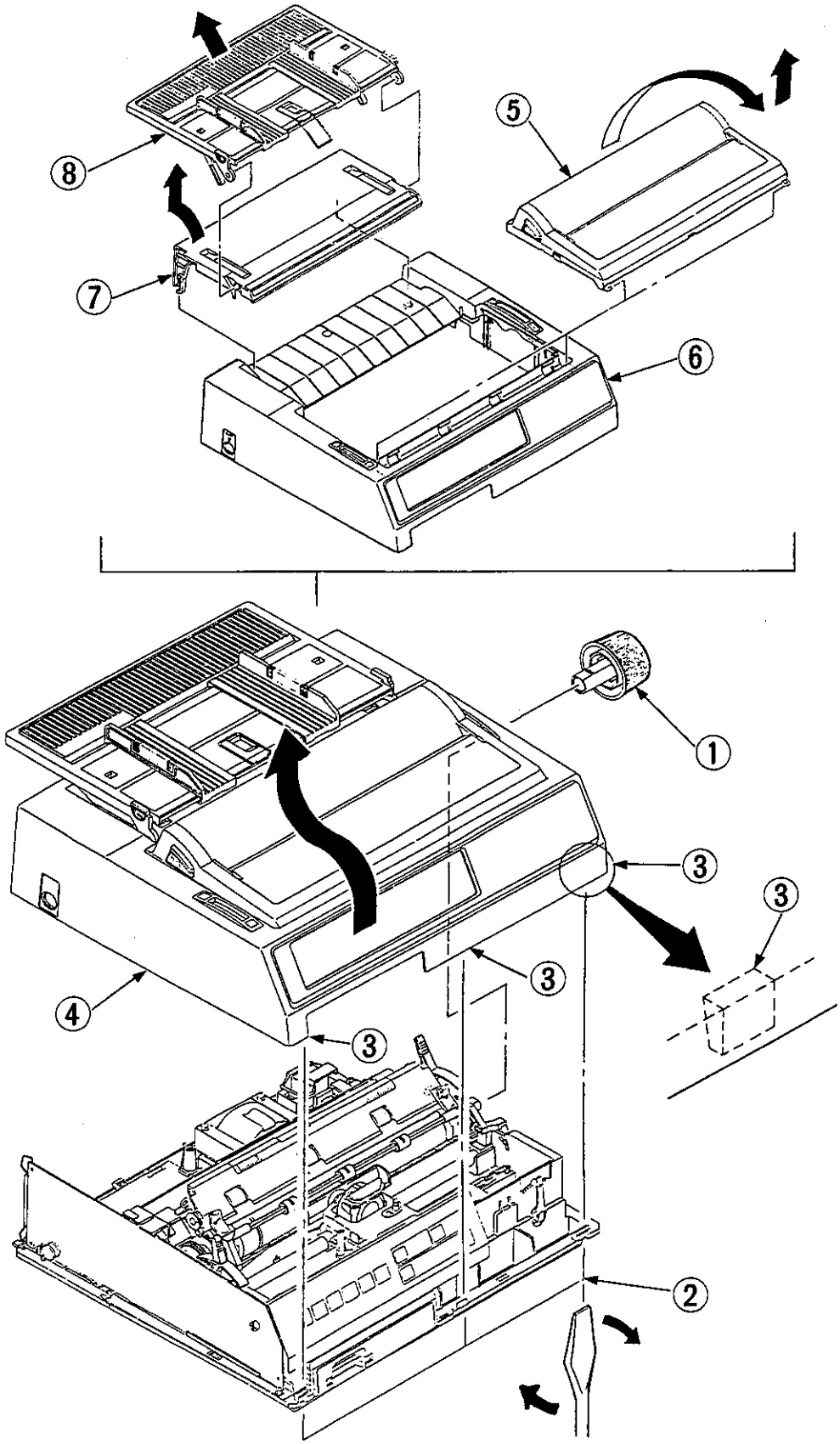
(2) Insert a flat-blade screwdriver through slots ② in the main frame and disengage the claw ③ of the upper cover.

(3) Lift the front of the upper cover assy ④ and remove it by pushing backward and pulling up.

(4) Open and take out the access cover ⑤ from the middle cover ⑥.

(5) Remove the sheet separator ⑧ from the rear cover ⑦.

(6) Remove the rear cover ⑦ from the middle cover ⑥.
(Position rear cover ⑦ upright and pull upward.)


8
5
7
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2

4.3.4 Control board

(1) Remove the upper cover assembly. (See 4.3.3.)

(2) Turn the locking post ① 90° clockwise (O direction) to unlock it.

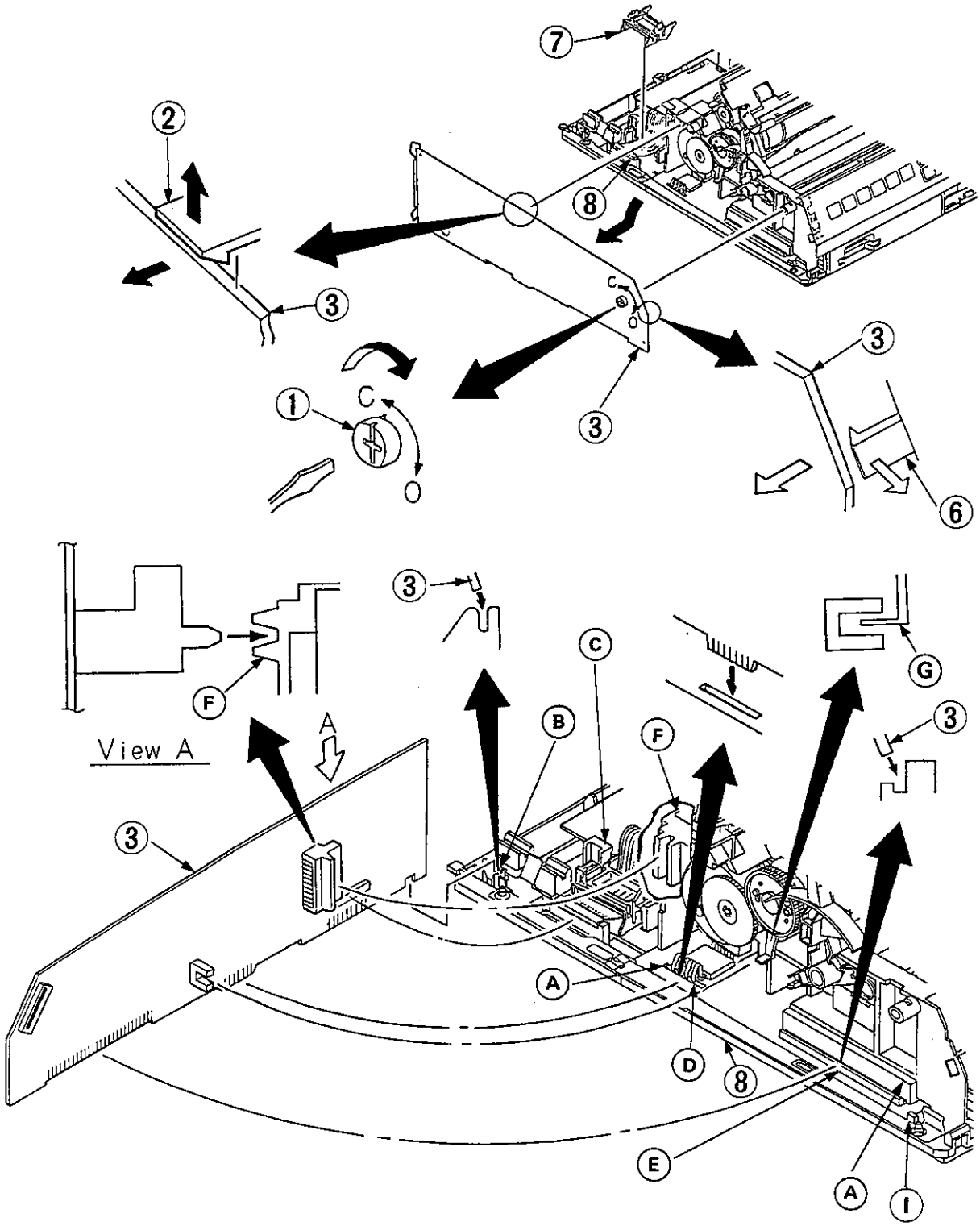
(3) Push the board clamp ② upward.

(3)' Lift the nail ⑥ of operator panel from and pull the control board ③ to the left.

(4) Slant the control board ③ 45° and pull it out upward.
Remove the cord clamp ⑦ and pull out the connector ⑧.

[Notes on installation]

1. *Do not touch the exposed terminals (crimp terminals Ⓐ) in the connector and control board ③. Protect these terminals from dirt and dust.*
2. *Install the board so that the following parts are securely connected. Guide Ⓑ, Cord guide Ⓒ, Connection plate Ⓓ, Connector Ⓔ, Guide Ⓕ, Guide ①, Sensor lever Ⓖ.*
3. *Install a piece of paper into the printer to prevent sensor lever Ⓖ to touch with the paper end sensor, and install the control board with the sensor lever Ⓖ pressed down.*


7
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C
O
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6
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A
View A
C
B
F
G
3
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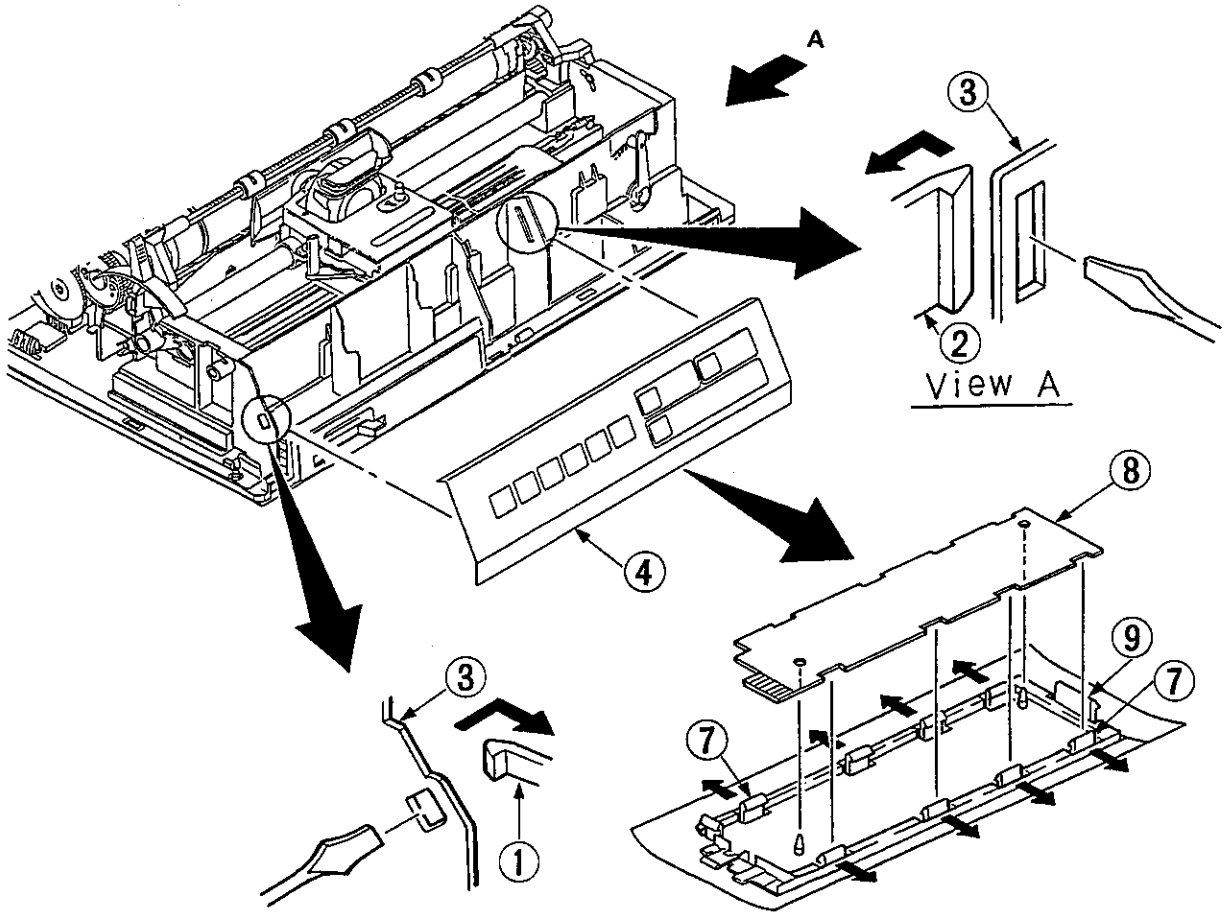
D
8
E
A
I

4.3.5 Operator Panel

(1) Remove the control board. (See 4.3.4.)

(2) Push the claws ① and ② inward and remove the operator panel ④ from the main chassis ③

(3) Push the eight claws ⑦ outward and remove the operator panel circuit board ⑧ from the panel frame ⑨.


A
3
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View A
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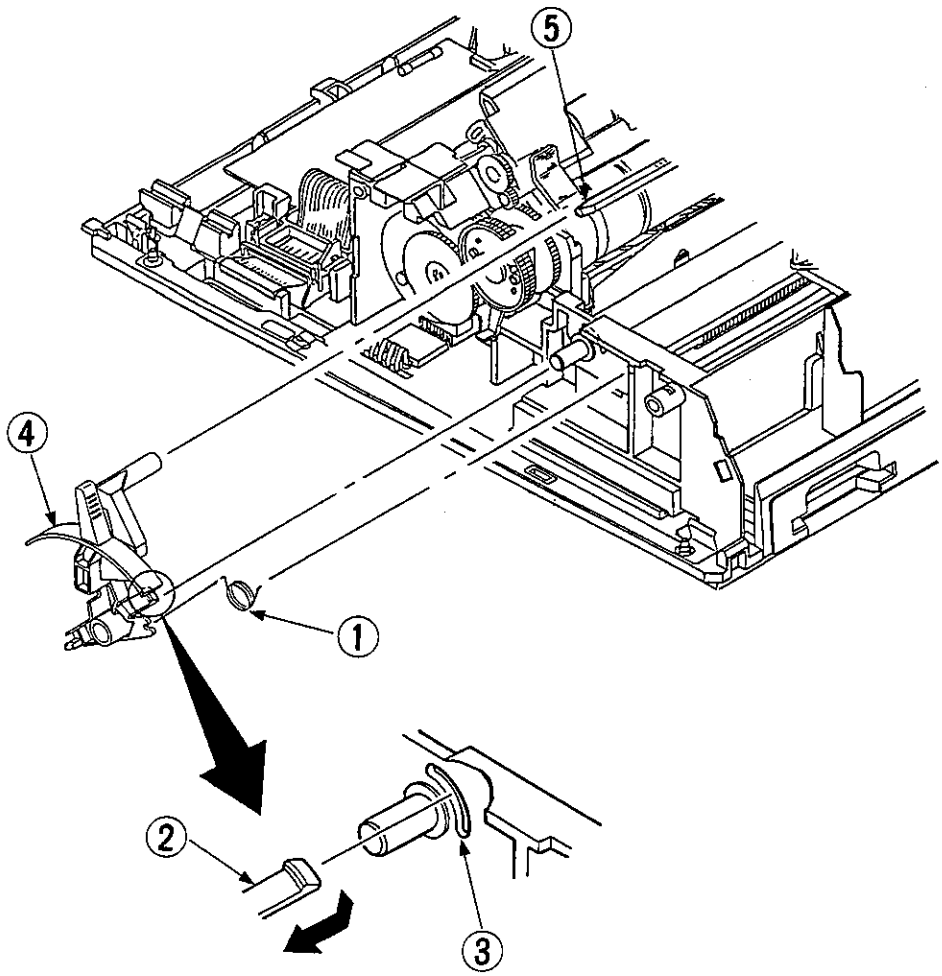
1

4.3.6 Bail arm (L)

(1) Remove the control board. (See 4.3.4.)

(2) Remove the bail arm spring (L) ① with pliers.

(3) Push the claw ② outward and remove the bail arm (L) ④ by pulling it from the guide hold ③ in the main frame (the arm is also removed from the bail bar ⑤).



4.3.7 Connection board (SRBS)

(1) Remove the control board. (See 4.3.4.)

(2) Pull the connector ① to the left to remove it.

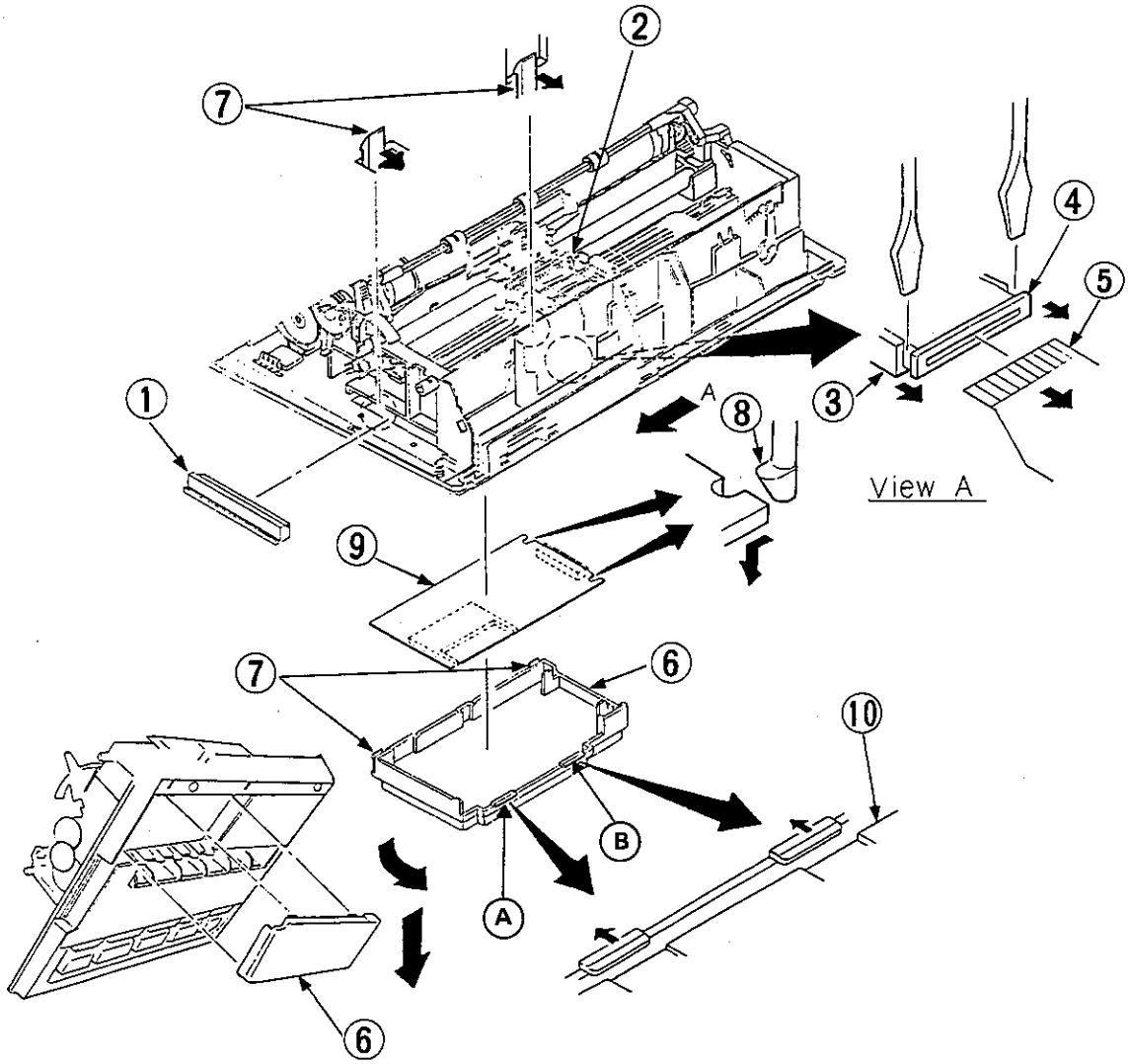
(3) Unlock the cable clamp ④ of the connector ③ and remove the head cable ⑤.

(4) Pull the two claws ⑦ of the board clamp cover ⑥ towards you to unlock them, then press down the claws to remove the board clamp cover ⑥. (See the sketch of the bottom face.)

(5) Pull the connection board ⑨ to the left to remove it from the claws ⑧, and press down the board to remove it. (Handle from the rear of the main frame.)

[Note on installation]

Insert the claws Ⓐ and Ⓑ of the board clamp cover ⑥ to the main frame ⑩ previously, then install the board by fitting the claws ⑦.

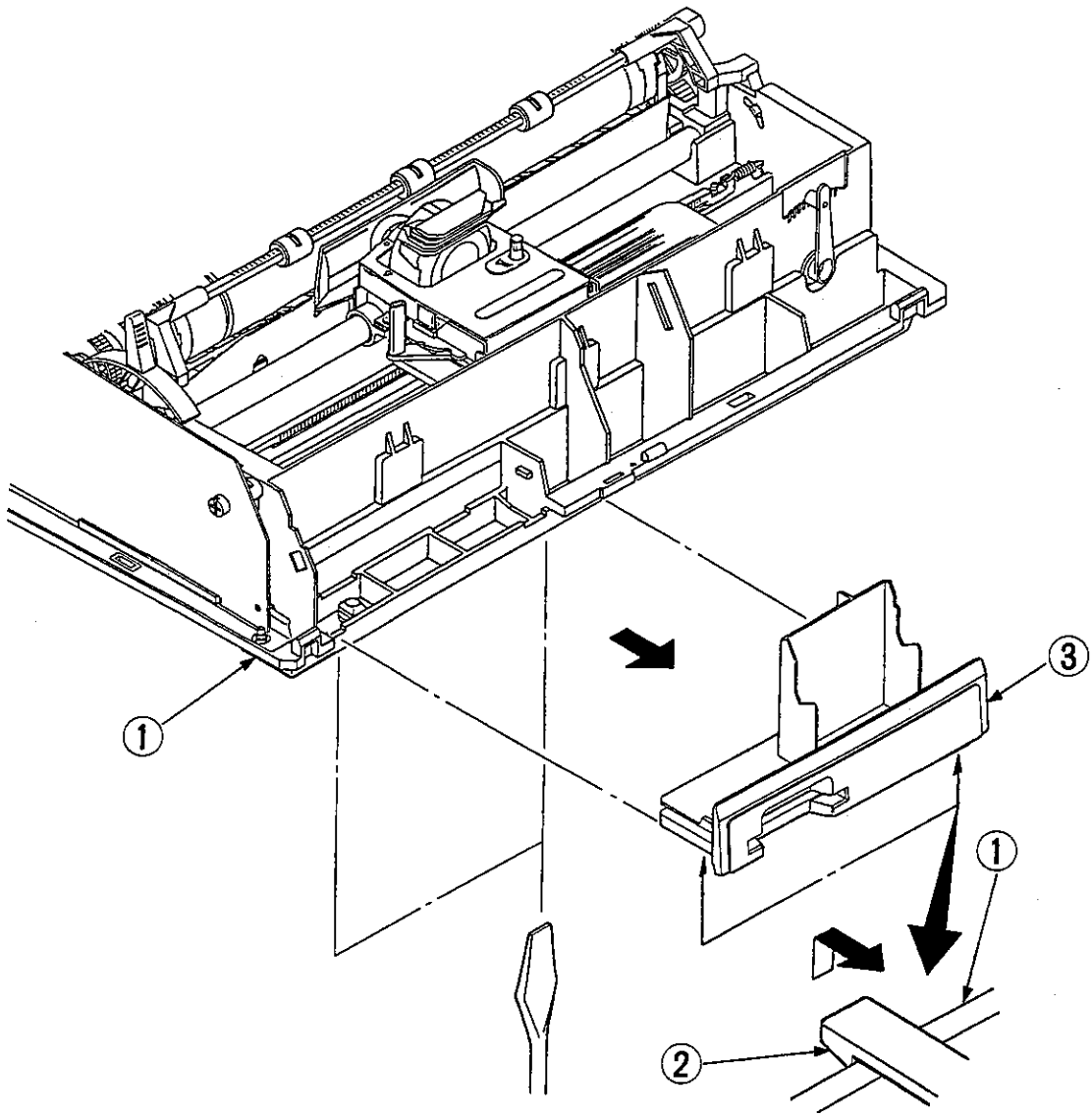


Bottom view

4.3.8 IC card panel

(1) Remove the operator panel. (See 4.3.5.)

(2) Insert a flat-blade screwdriver from the back of the main frame ① and push the two claws ② on the IC card panel ③ to unlock it. Pull the panel toward the front of the printer to remove it. (Handle from the bottom of the main frame.)



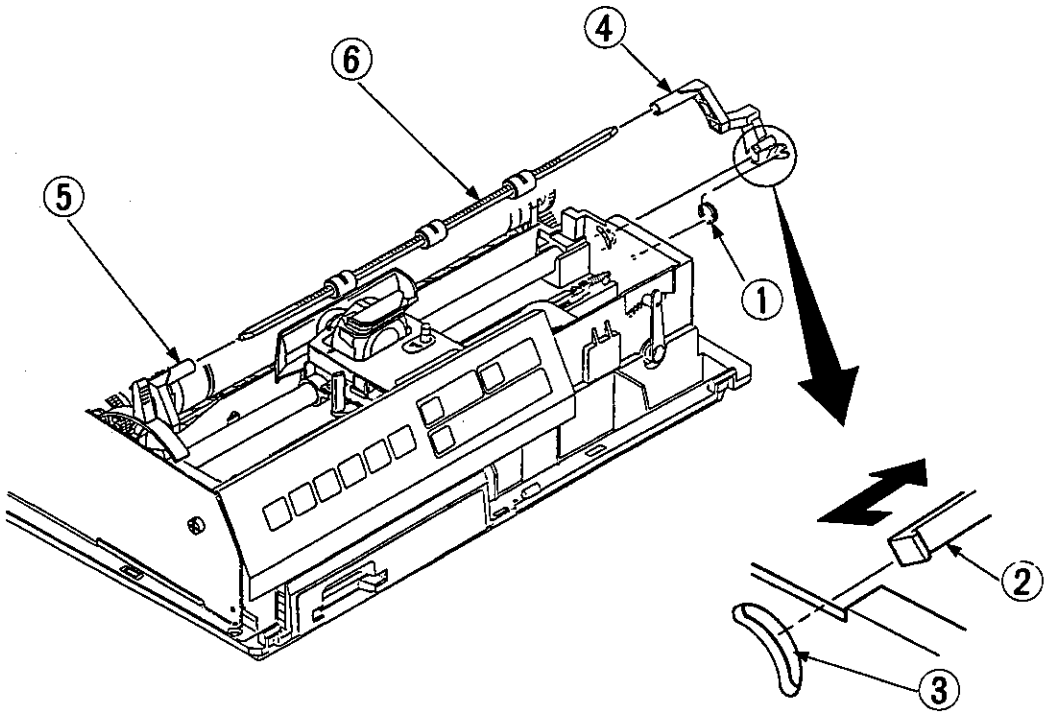
4.3.9 Bail arm bar

(1) Remove the upper cover assembly. (See 4.3.3.)

(2) Remove the bail arm spring (R) ① with pliers.

(3) Push the claw ② outward and remove the bail arm (R) ④ by pulling it through the guide hole ③ in the main frame.

(4) Remove the bail arm bar ⑥ by pulling it out from the bail arm (L) ⑤.



4.3.10 Transformer

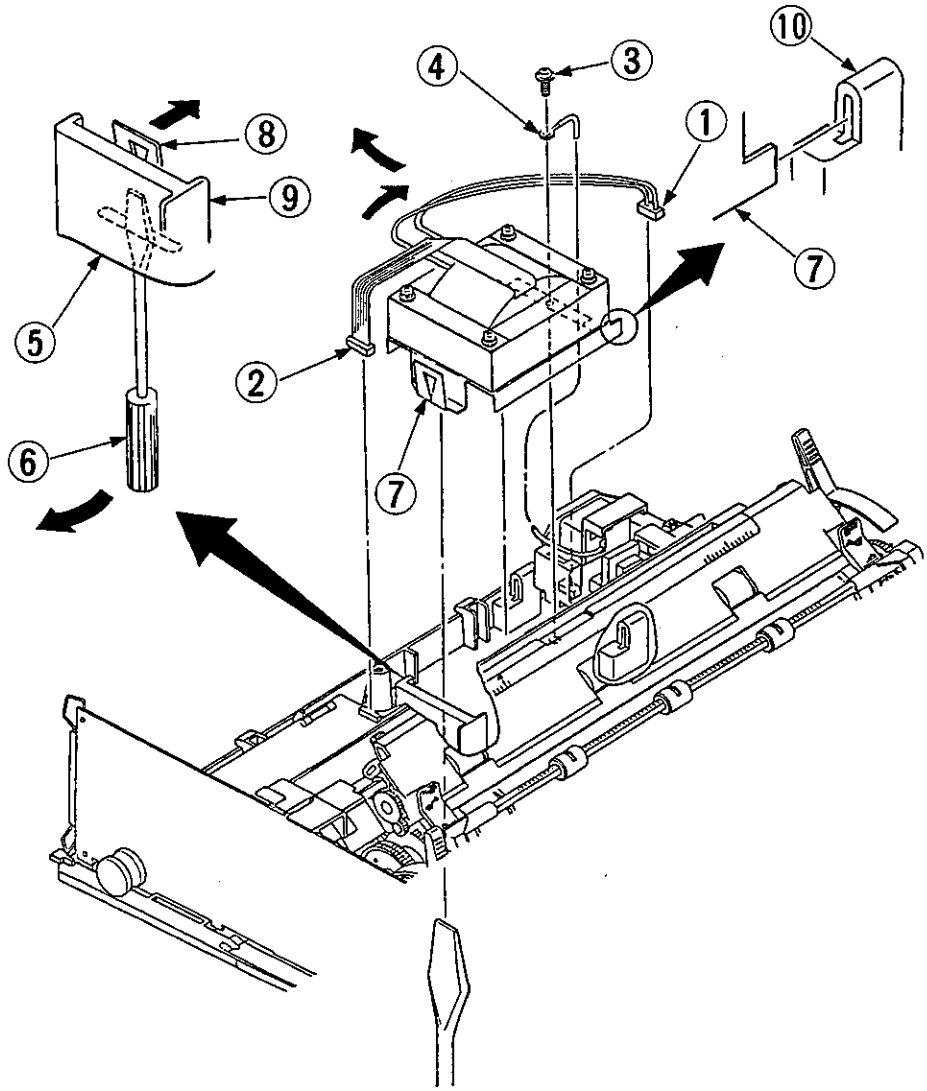
(1) Remove the upper cover assembly. (See 4.3.3.)

(2) Disconnect the cable ① from the filter assembly and cable ② from the power supply board.

(3) Remove the screw ③ and grounding wire ④.

(4) Insert a flat-blade screwdriver ⑥ into the main frame ⑤ from the bottom, pushing the lock spring ⑧ on the transformer to the right and remove the spring ⑧ from the transformer clamp A ⑨.

(5) Lift the left side of the transformer and pull it to the left to ⑦ remove it from the transformer clamp B ⑩.

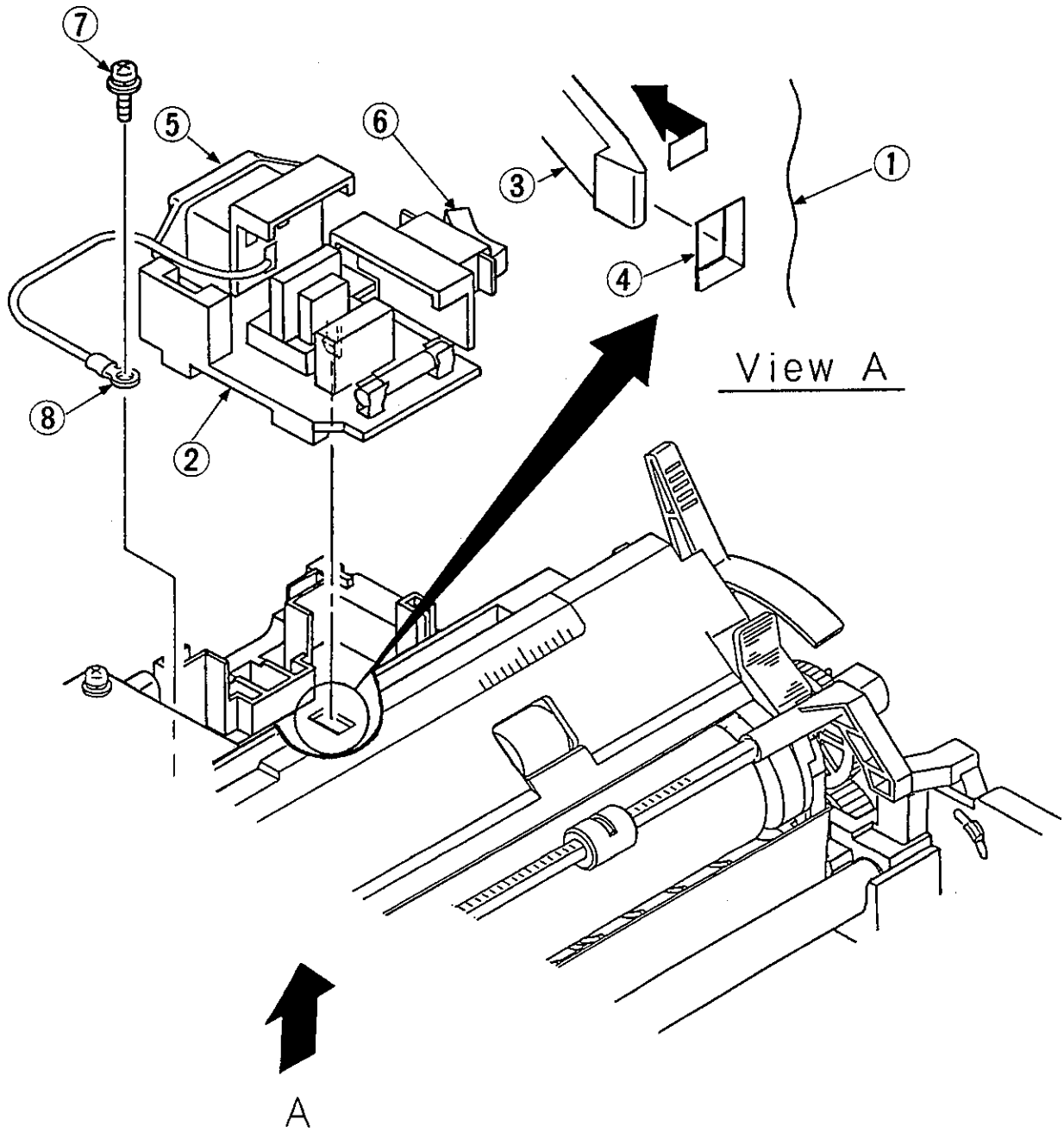


4.3.11 Filter assembly

(1) Remove the screw ⑦ and grounding wire ⑧ from transformer and disconnect the cable from the filter assembly ②.

(2) Remove the claw ③ of the filter assembly ② from its locking position ④ by pushing it from the bottom of the main frame ①.

(3) Remove the filter assembly ② by lifting the AC inlet ⑤ and AC POWER switch ⑥ from the guides of the main frame.

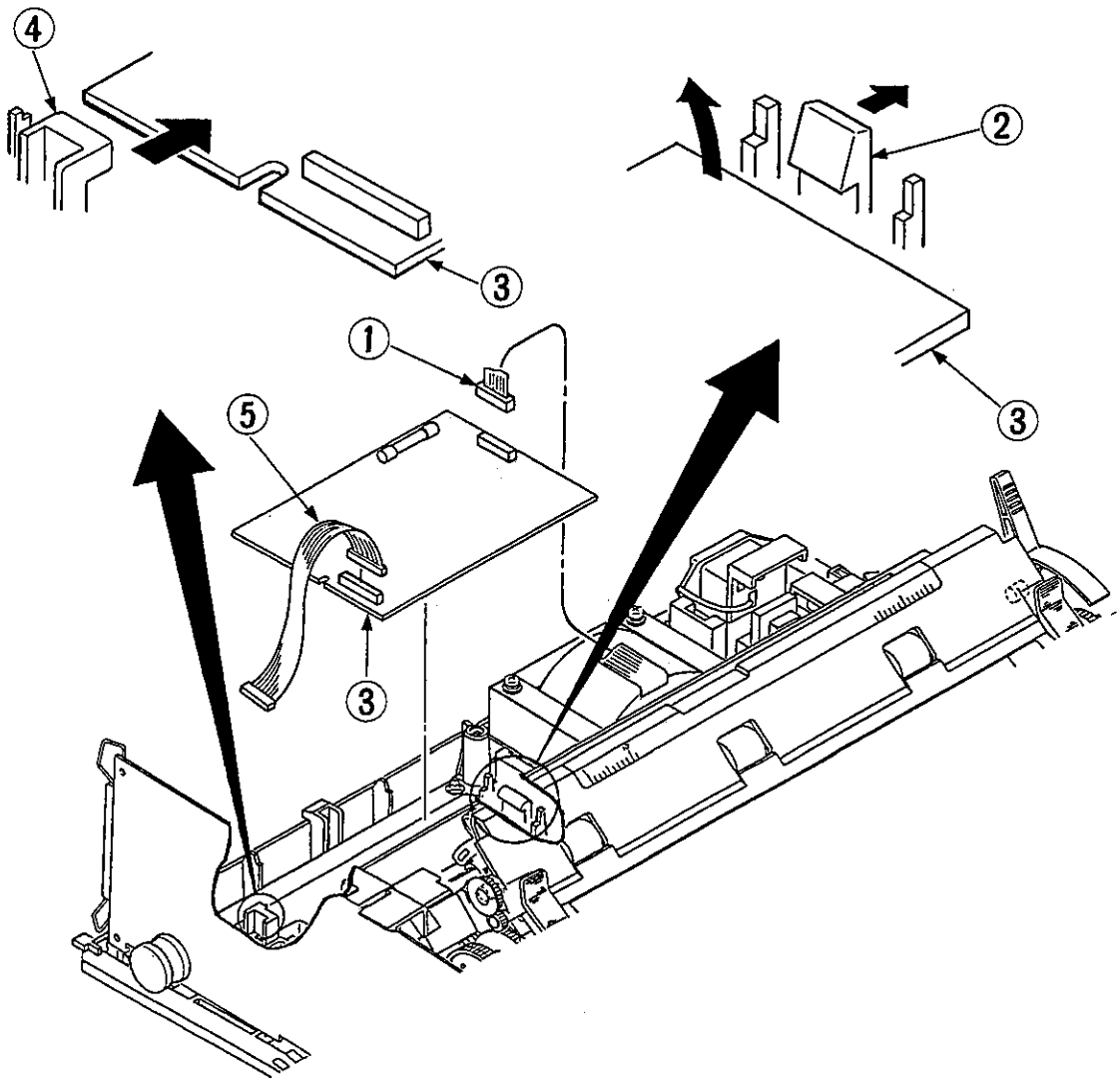


4.3.12 Power supply board

(1) Remove the upper cover assembly. (See 4.3.3.)

(2) Disconnect the transformer cable ① and connector cord ⑤.

(3) Push the board clamp claw ② to the right, lift the right side of the power supply board ③, and remove its left side from the PCB holder ④.

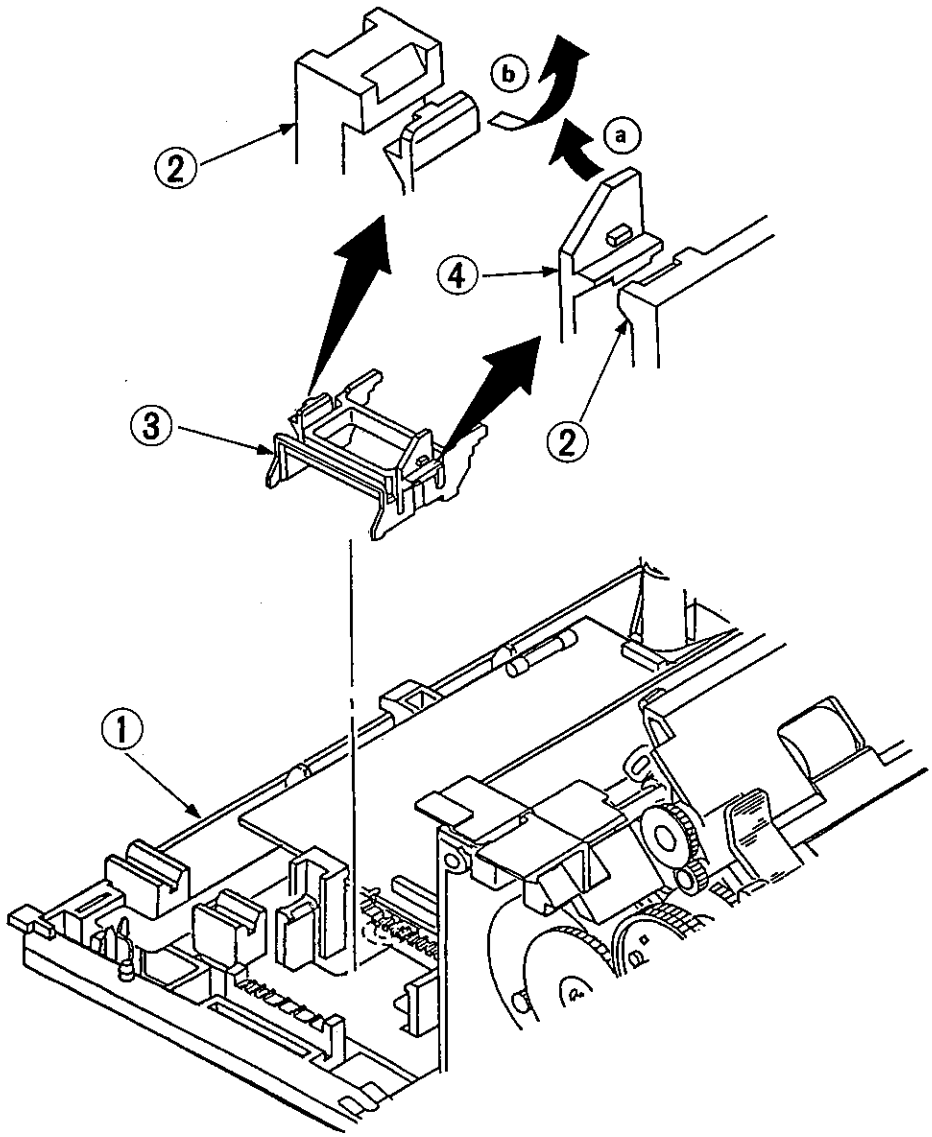


4.3.13 Connector cord

(1) Remove the control board. (See 4.3.5.)

(2) Remove the power supply board. (See 4.3.12.)

(3) Remove the cord clamp ③ by removing the locking spring ④ on the module from the module clamps ② on the main frame ① (in the order of Arrows ⓐ, ⓑ).



4.3.14 Ribbon drive gear assembly

(1) Remove the upper cover assembly. (See 4.3.3.)

(2) Remove the ribbon cassette ①.

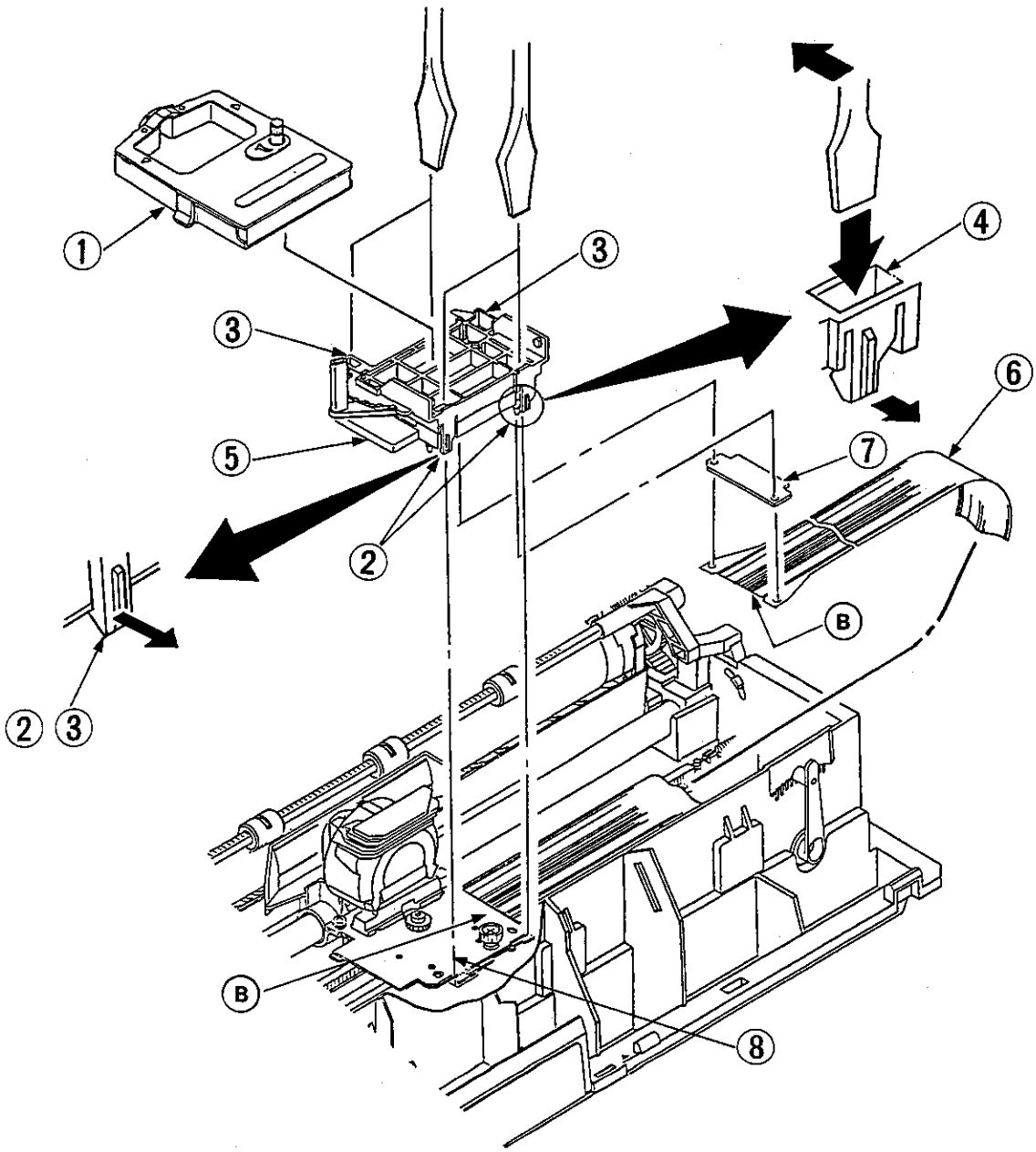
(3) Remove the two front claws ② and two rear claws ③ by pushing the claws outward with a flat-blade screwdriver inserted through the hole ④.

(4) Pull upward to remove the ribbon drive gear assembly ⑤.

(5) Remove the head cable ⑥, and contact pressure rubber ⑦ from the drive assembly.

[Notes on installation]

1. *Do not touch the exposed terminals (crimp terminals) B on the carriage cable ⑥ and space motor assembly ⑧. Protect these terminals from dirt and dust.*
2. *Do not bend the head cable ⑥ at acute angles or creasing of the cable could occur.*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B
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B
8

4.3.15 Space motor assembly

(1) Remove the ribbon drive gear assembly. (See 4.3.14.)

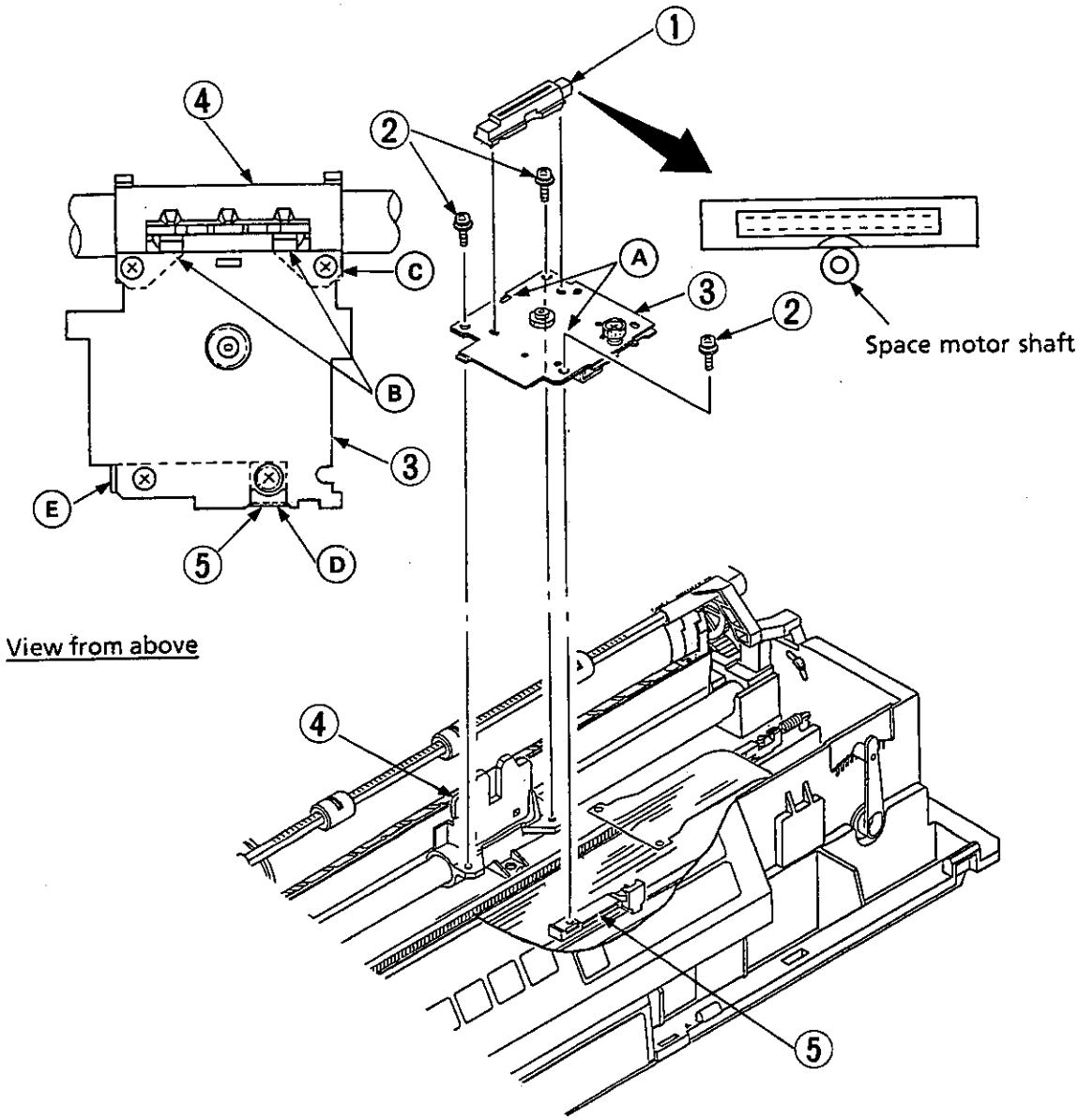
(2) Remove the connector ① noting the position of the indentation in its surface.

(3) Remove the three screws ②.

(4) Remove the space motor assembly ③. Be careful not to lose slider ⑤.

[Notes on installation]

1. *Do not touch the exposed terminals (crimp terminals) A on the space motor assembly ③. Protect such terminals from dirt and dust.*
2. *Install the space motor assembly ③ over the carriage frame ④.*
3. *Install the slider ⑤ by fitting the portions Ⓓ and Ⓔ to the space motor assembly. Make sure the groove of the slider is positioned over the lip of the guide rail.*
4. *After installing the ribbon drive gear assembly, check and adjust the gap between the platen and print head. (See 5.1.)*


1
4
2
C
A
3
2
Space motor shaft
B
3
E
5
D
View from above
4
5

4.3.16 Carriage frame

(1) Remove the space motor assembly. (See 4.3.15.)

(2) Remove the head clamp ①.

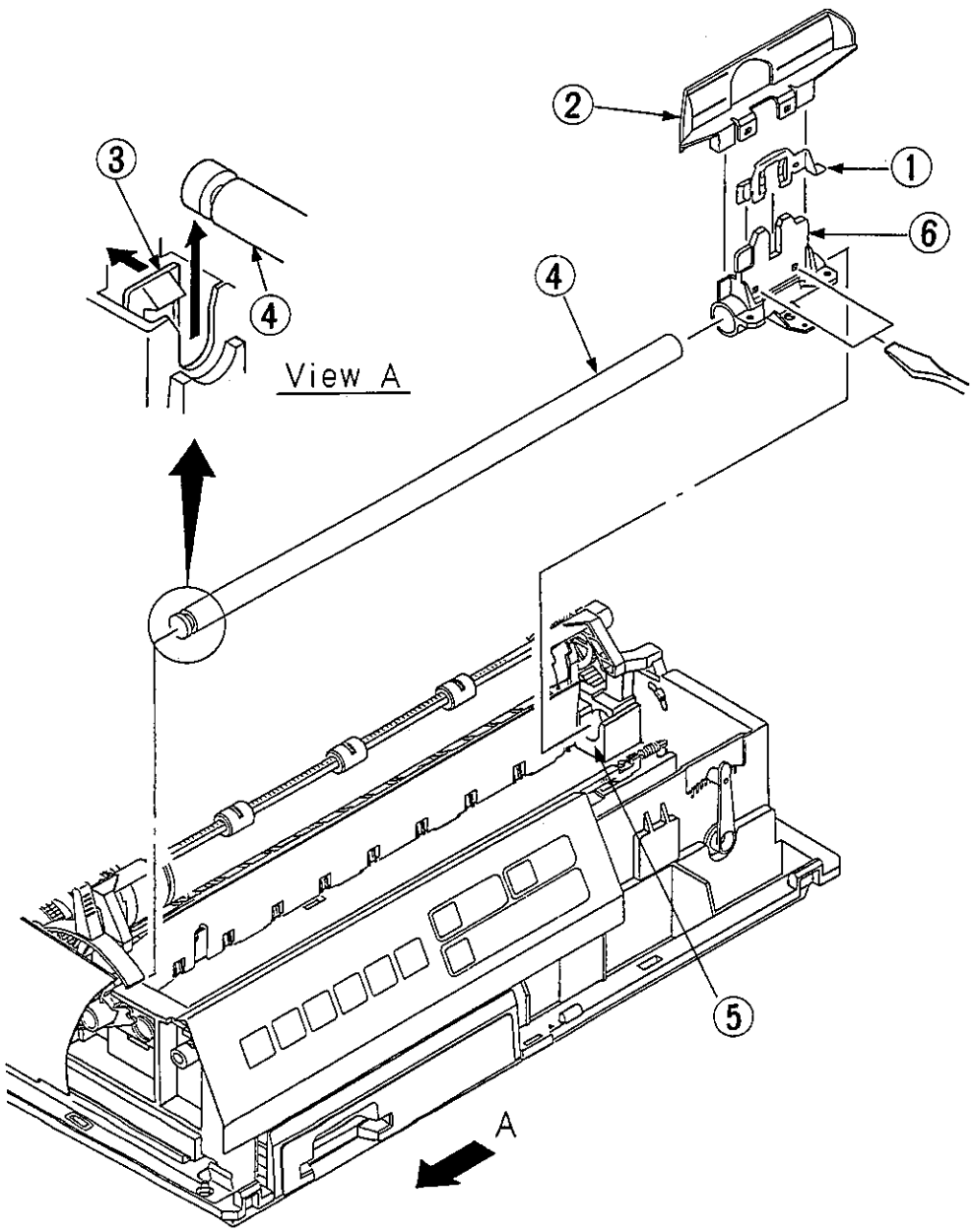
(3) Remove the ribbon protector ②. (See 4.3.21.)

(4) Push the shaft clamp ③ to the left on the main frame and lift the left end of the carriage shaft ④. Then, pull the right end of the shaft out from the guide hole ⑤.

(5) Pull out the carriage shaft ④ from the carriage frame ⑥.

[Note on installation]

After installing the carriage frame, adjust the gap between the platen and printhead. (See 5.1.)



4.3.17 Space rack

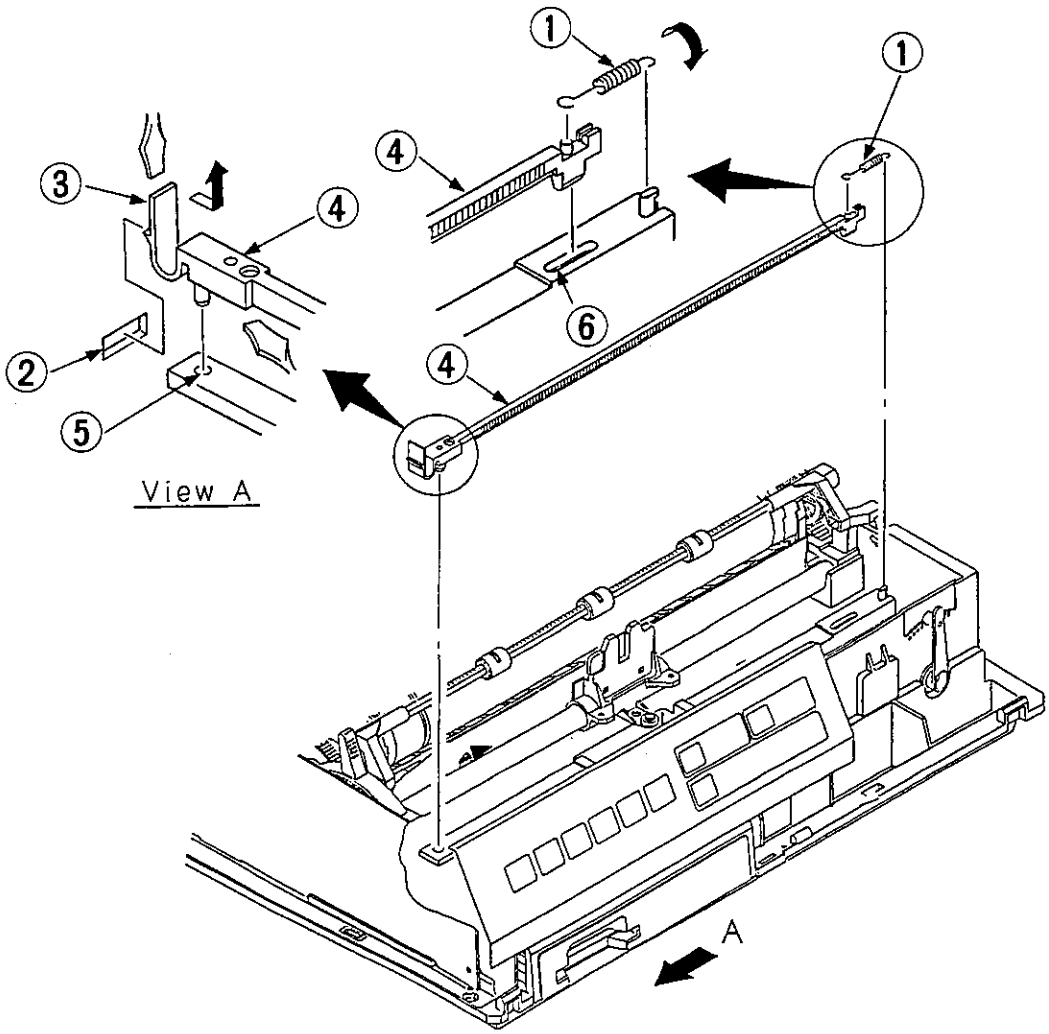
(1) Remove the space motor assembly. (See 4.3.15.)

(2) Remove the spring ①.

(3) Pull up the space rack ④ upward while disengaging the claw ③ from the insertion hole ② in the main chassis. Remove space pack.

[Notes on installation]

1. *When installing the spring ①, twist its right end 90° counterclockwise.*
2. *Install the rack so that it connects into the two guide holes ⑤ and ⑥.*
3. *After installing the space motor assembly, check and adjust the gap between the platen and printhead assembly. (See 5.1.)*



4.3.18 Guide rail

(1) Remove the space motor assembly. (See 4.3.15.)

(2) Remove the adjusting cam ① in the following steps.

(a) Pull portion Ⓐ of the adjusting cam ① outward and turn it clockwise until it is in a horizontal position.

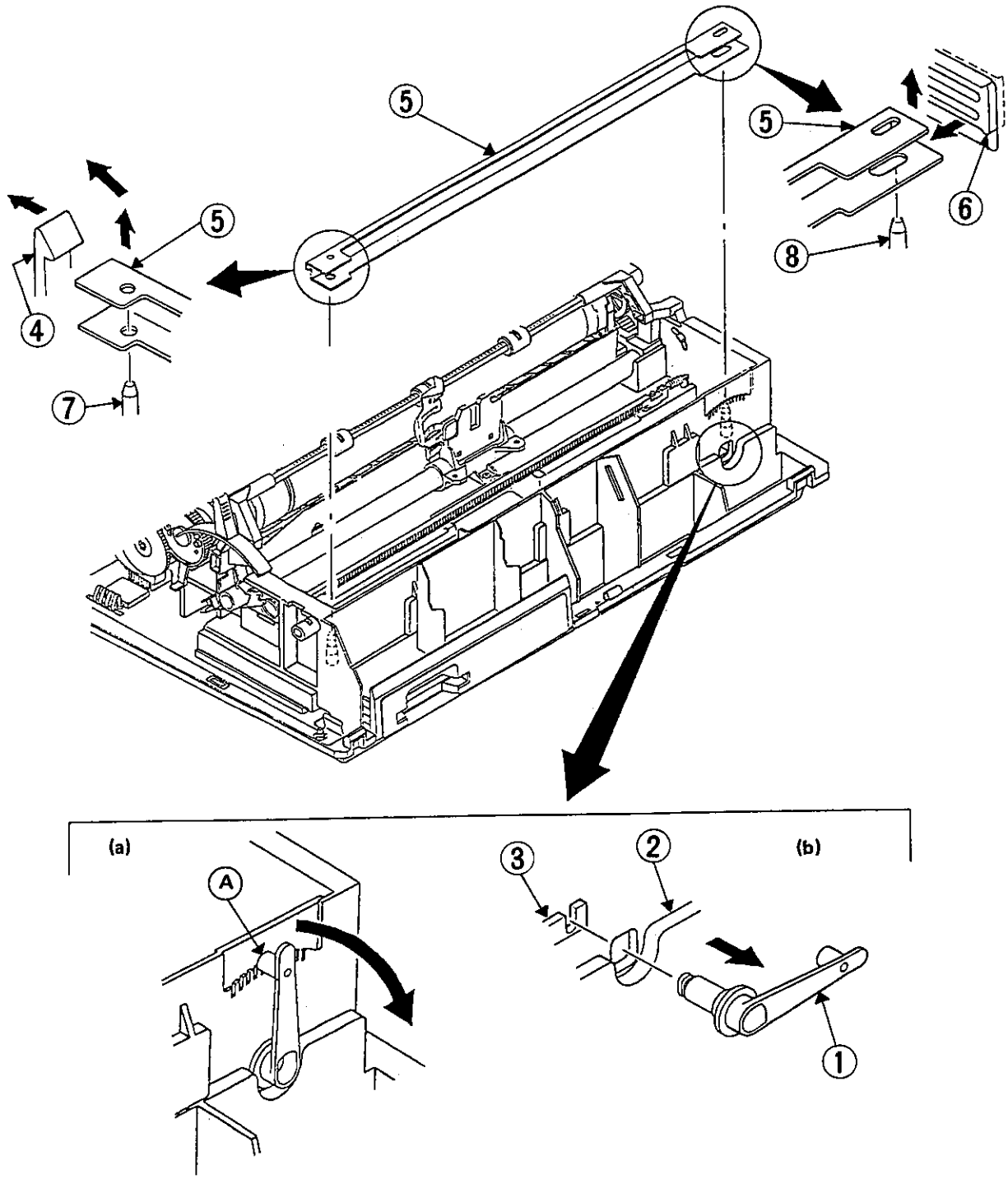
(b) Remove the cam by pulling it outward through the guide ③ in the main frame ②.

(3) Push the claw ④ outward and disengage it from the left end of the guide rail ⑤.

(4) Remove the right end of the guide rail ⑤ by pulling it from the guide ⑥ in the main frame and lifting it out.

[Notes on installation]

1. *Install the guide rail so that it seats over the two guide pins ⑦ and ⑧.*
2. *After installing the guide rail, adjust the gap between the platen and printhead. (See 5.1.)*


5
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5
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8
4
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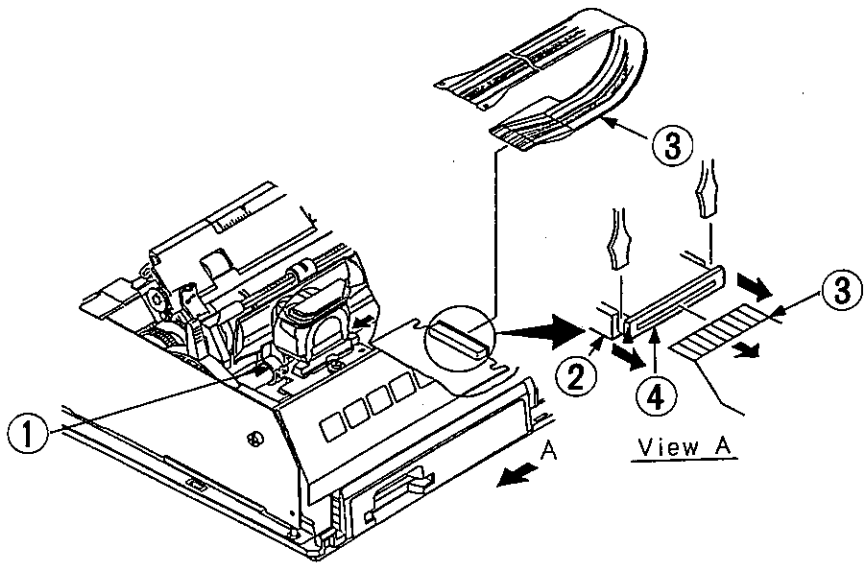
(a)
A
(b)
3
2
1

4.3.19 Head cable

(1) Remove the ribbon drive gear assembly. (See 4.3.14.)

(2) Slide the carriage all the way to the left ①.

(3) Unlock the cable clamp ④ of the connector ② on the connection board and disconnect the head cable ③.



4.3.20 Platen assembly

(1) Remove the upper cover. (See 4.3.3.)

(2) Remove the separator assembly ① from the platen ② by tilting it backward.

(3) Move the bail arm toward the front of the printer (open position).

(4) Push the release lever ⑦ to its rear position.

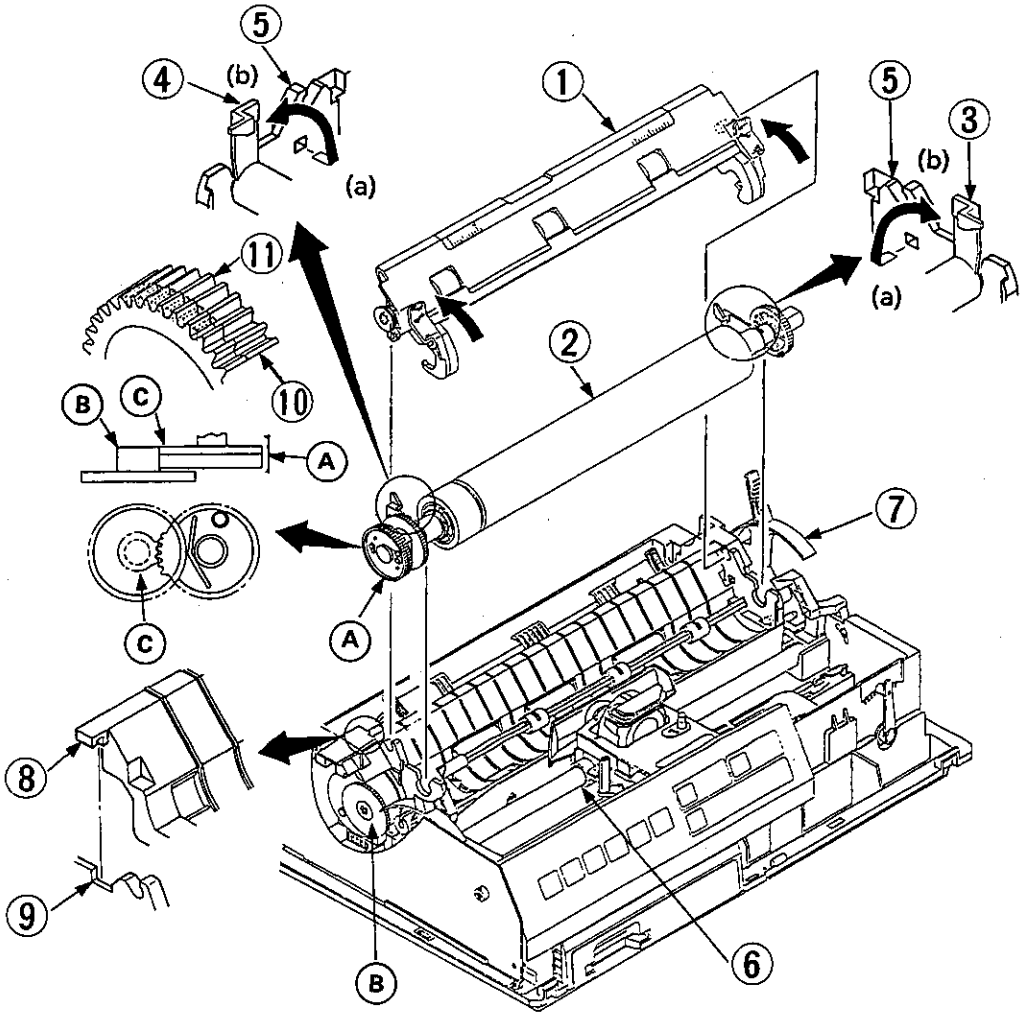
(5) Pull the lock levers ③ and ④ in the direction of the arrow (a) and move them 90° upward (arrow (b)). This releases the platen assembly ② from the main frame ⑤.

(6) Move the carriage frame ⑥ to the right end, lift the left end of the platen assembly ②, and return the frame to the left end.

(7) Remove the platen assembly ② from the main frame by lifting its right end.

[Notes on installation]

1. *When mounting the platen assembly, the teeth of the platen gear ⑩ and bias gear ⑪ must be arranged in the same position and mesh the teeth ⓒ of LF motor gear. (Since there is a discrepancy of approx. quarter pitch between the bias gear and the platen gear, be careful when remounting, to maintain the two teeth of both gears in the same position.)*
2. *After installing the platen assembly, verify that the gears engage securely at Ⓐ and Ⓑ, and the platen turns smoothly.*
3. *Lock the platen assembly after setting the release lever ⑦ to the open (forward) position, and confirming that the paper chute positioning tab ⑧ is properly engaged in the main frame groove ⑨.*



4.3.21 Ribbon protector

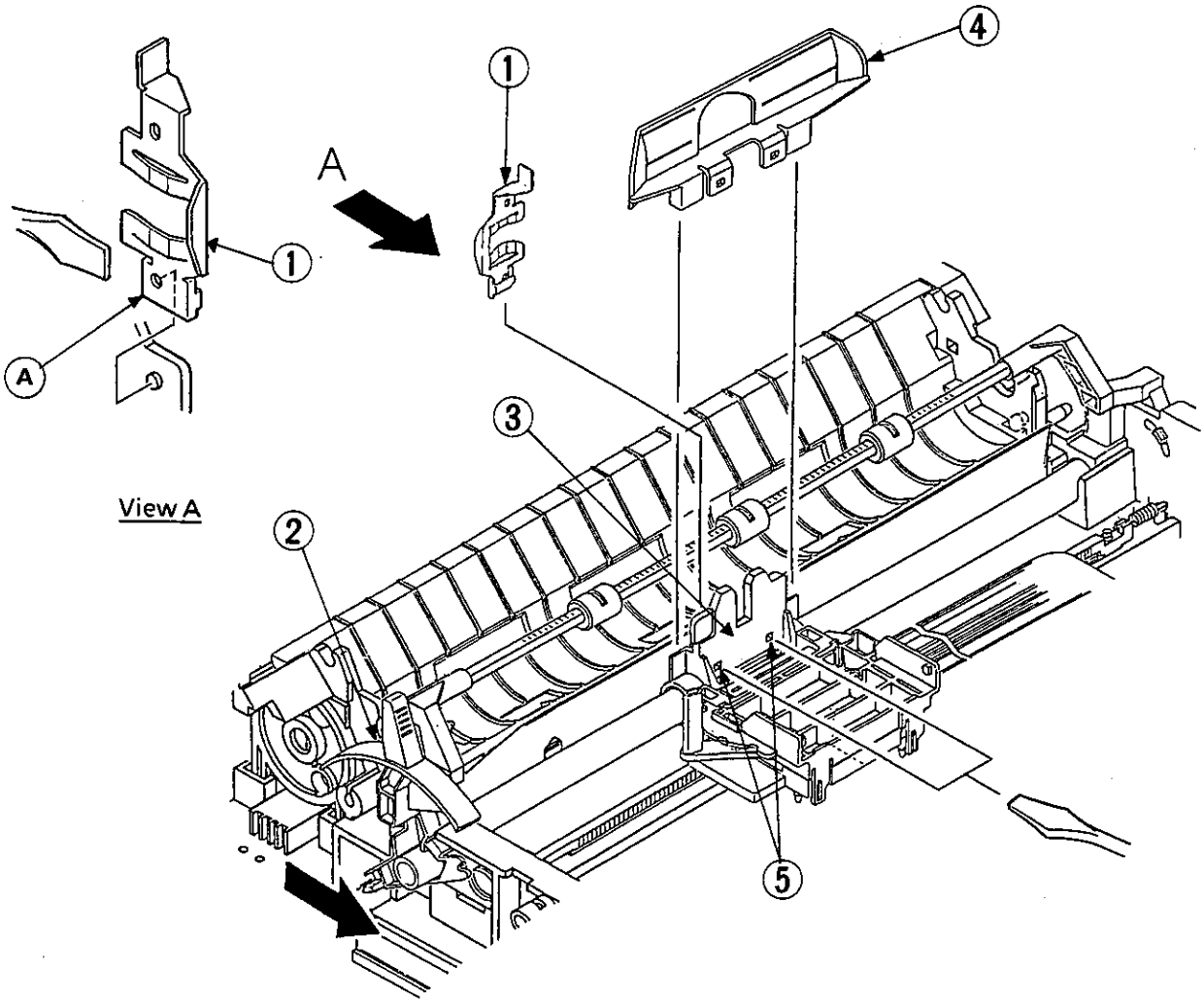
(1) Remove the printhead. (See 4.3.2.)

(2) Remove the platen assembly. (See 4.3.20.)

(3) Push the supporting point Ⓐ outward to remove the head clamp ①.

(4) Pull the bail lever ② toward the front of the printer.

(5) Remove the ribbon protector ④ from the carriage frame ③ by lifting it with a flat-blade screwdriver through a slot ⑤ in the carriage frame.



4.3.22 LF motor

(1) Remove the control board. (See 4.3.4.)

(2) Remove the platen assembly. (See 4.3.20.)

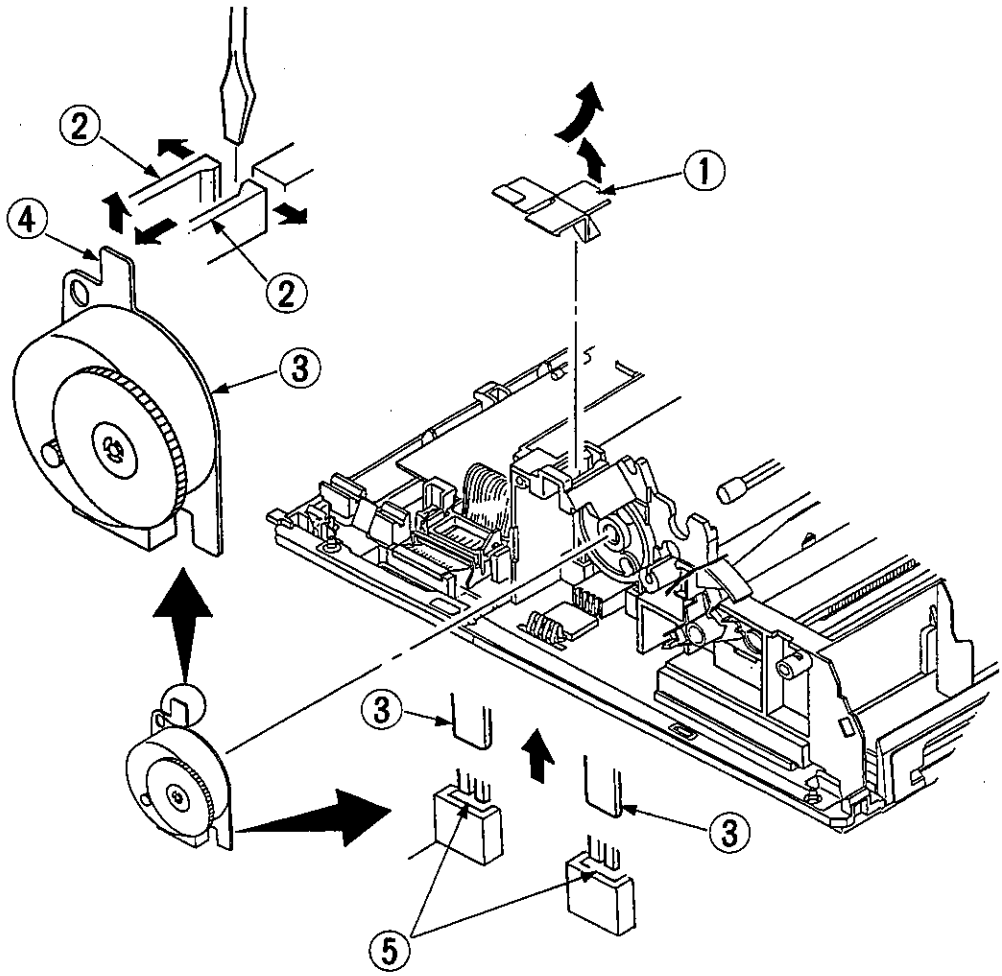
(3) Unlock the board lock ①.

(4) Open the lock levers ② and push the bracket ④ of the LF motor ③ outward to the left.

(5) Remove the LF motor ③ from the guide holes ⑤ below.

[Note on installation]

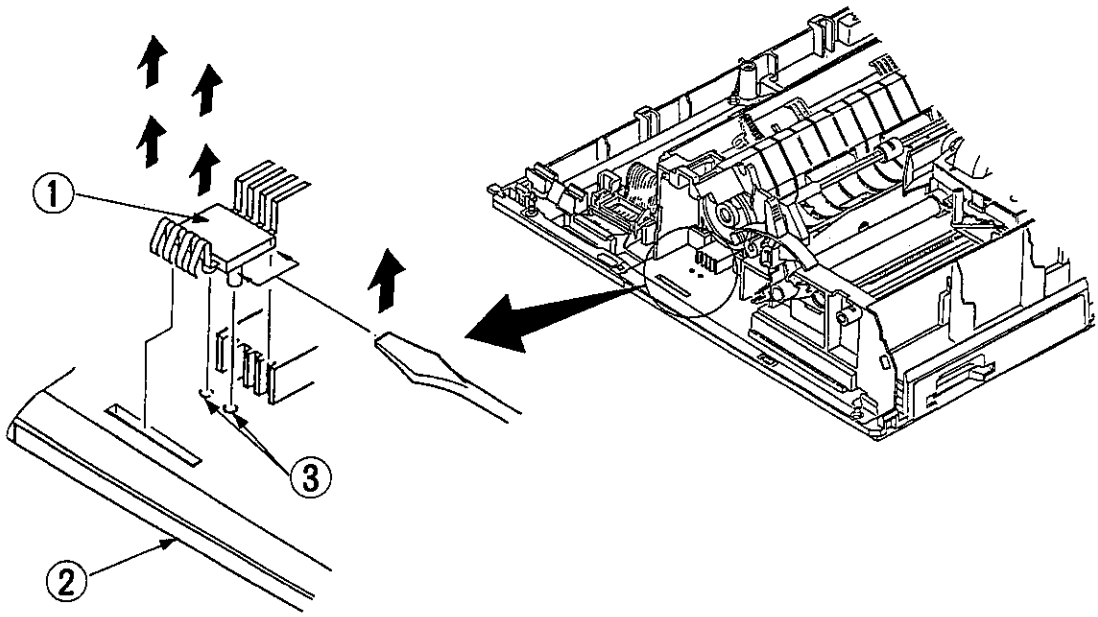
After installing the LF motor, verify that the gears engage securely, and the platen turns smoothly.



4.3.23 LF motor interconnect module

(1) Remove the LF motor. (See 4.3.22.)

(2) Insert a flat-blade screwdriver between the LF motor interconnect module ① and main frame ②, and remove the module ① from the two insertion holes ③.



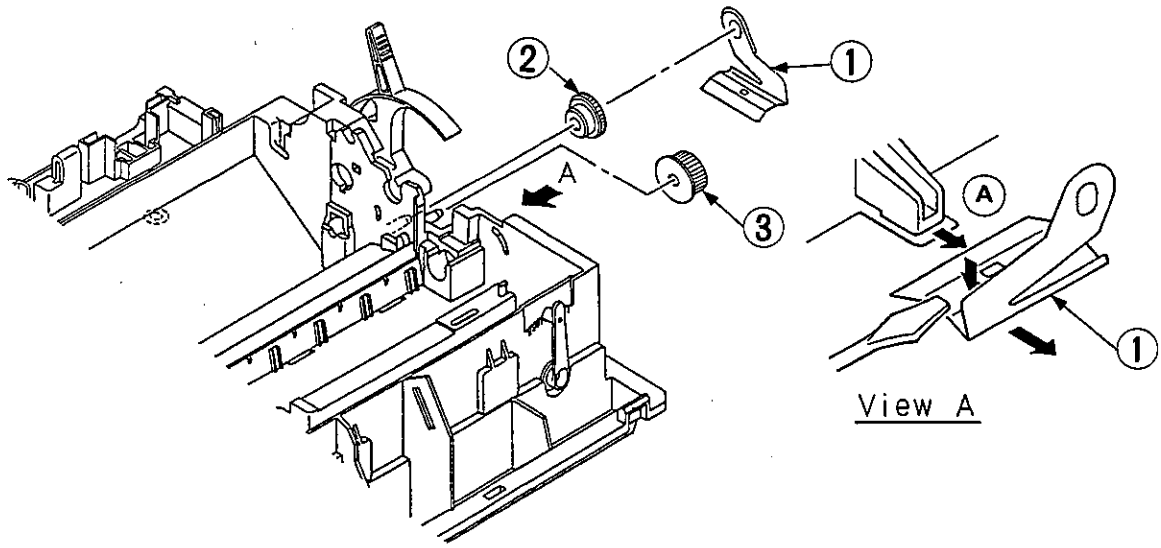
4.3.24 Idler gear

(1) Remove the platen assembly. (See 4.3.20.)

(2) Remove the reset spring ① as follows:

Push the reset spring ① downward at the center with a flat-blade screwdriver, and pull the spring in the direction of the arrow Ⓐ to remove it.

(3) Remove the change gear ② and idler gear ③.

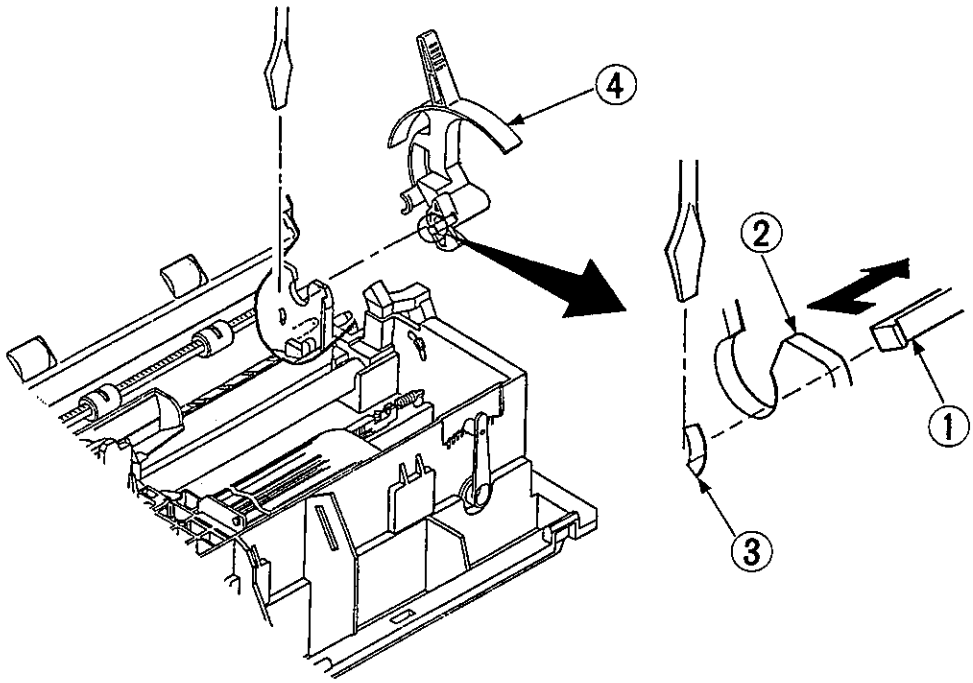


4.3.25 Release lever

(1) Remove the change gear. (See 4.3.24.)

(2) Push the claw ① from the guide ③ in the main frame, and pull the release lever ④ forward.

(3) Pull the release lever outward from the main frame to remove it.



4.3.26 Pressure roller assembly

(1) Remove the release lever. (See 4.3.25.)

(2) Remove the paper chute ①.

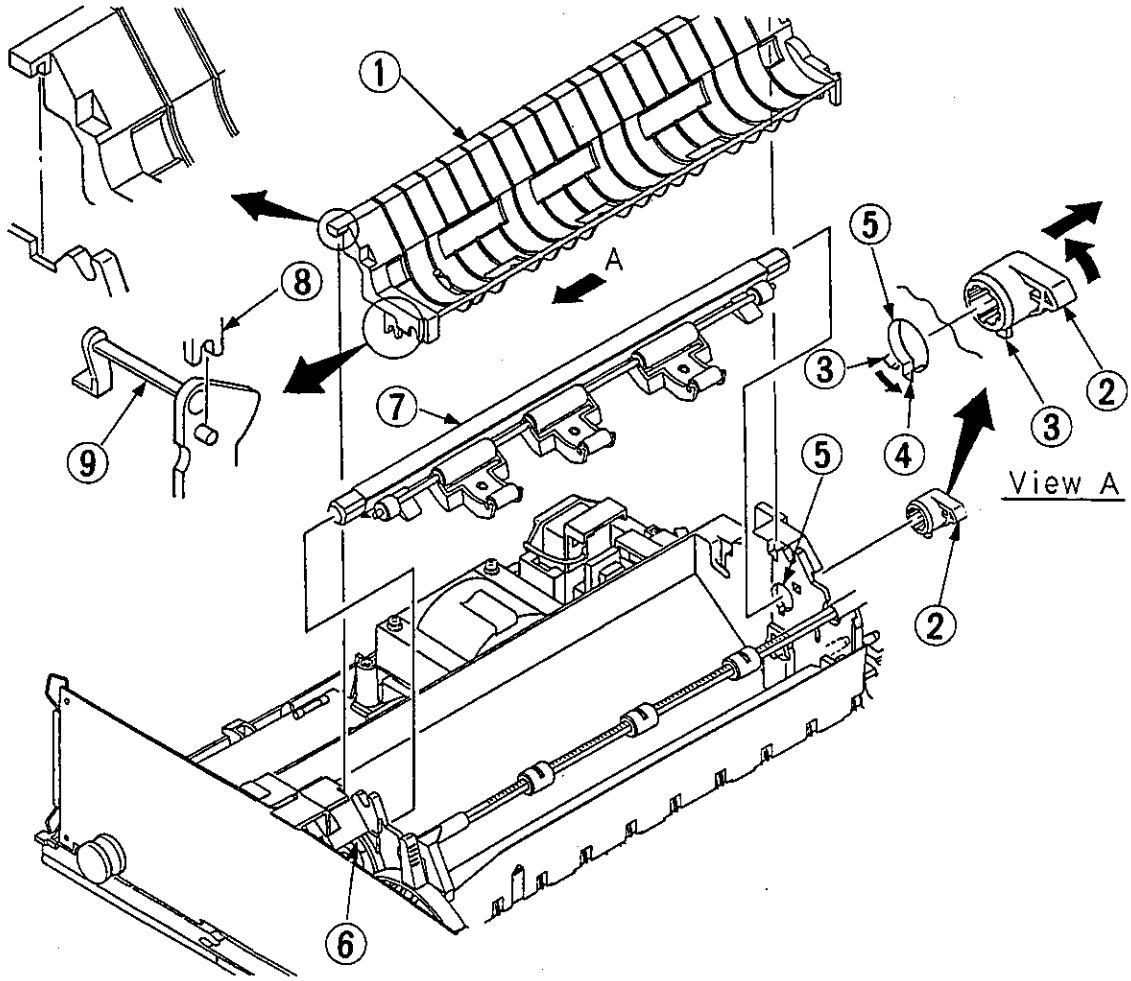
(3) Remove the release link ② as follows:

Turn the release link ② fully upward as viewed from View A. Align spline ③ with the slot ④ in the guide hole ⑤ in the main frame. Slide release link ② off of the pressure assembly ⑦ and remove from main frame.

(4) Remove the pressure assembly ⑦ by sliding it out through the guide holes ⑤ and ⑥.

[Note on installation]

Attach the paper end lever ⑧ on the paper chute to the shaft of the sensor lever ⑨. Make sure this is correct to avoid paper handling/paper end detection problems.



4.3.27 Tractor assembly

(1) Remove the tractor gear ① as follows:

Push the claw ② of the tractor gear ① outward and lift it from the groove ④ in the drive shaft ③. Then, slide the gear to the right and remove it.

(2) Remove the pressure roller assembly. (See 4.3.26.)

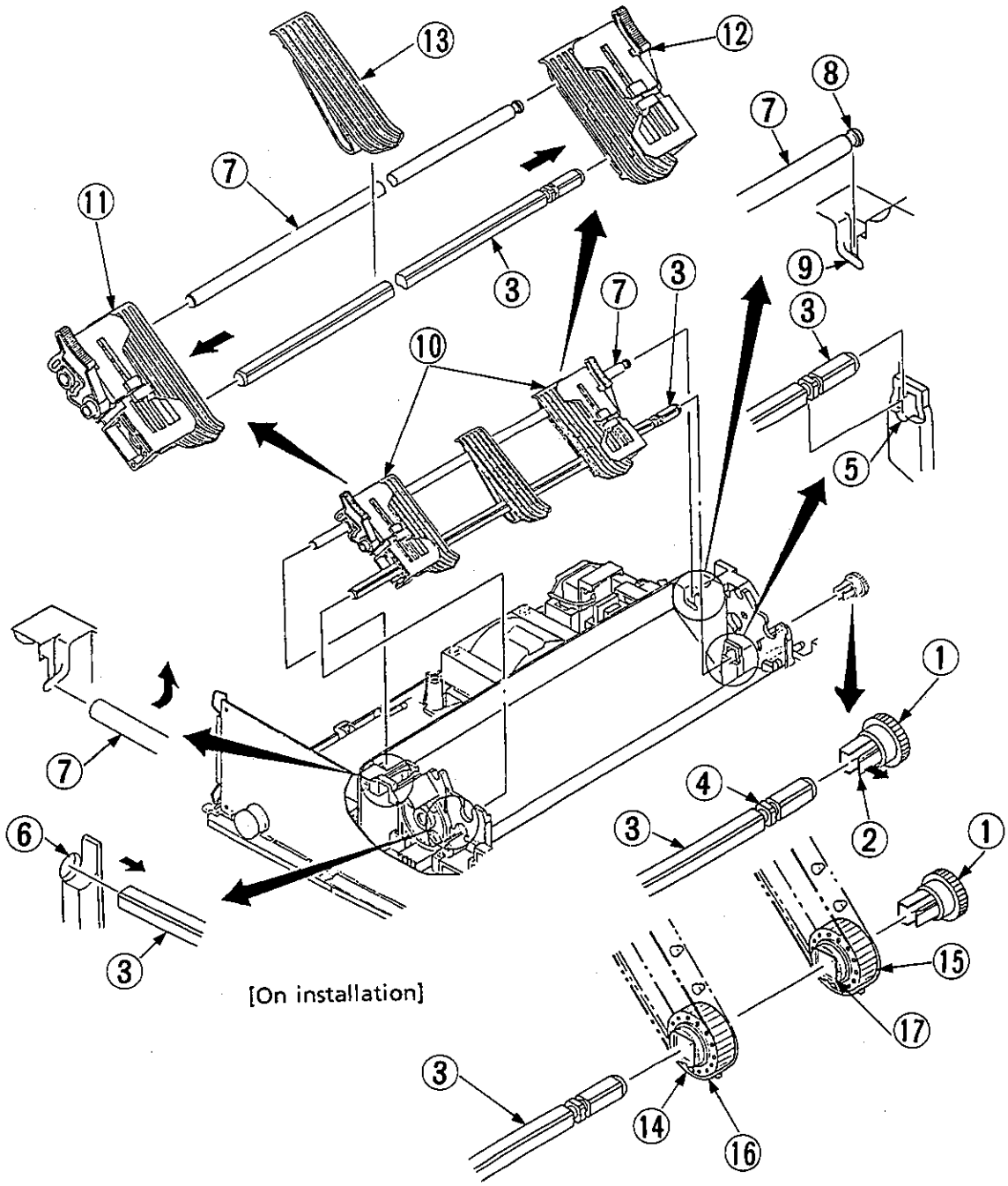
(3) Lift the drive shaft ③ above the guide ⑤ and slide it to the right until its left end is exposed from the guide hole ⑥.

(4) Remove the tractor assembly ⑩ by raising the slot ⑧ of the lock shaft ⑦ from the guide ⑨ and the drive shaft ③ from the right guide ⑤.

(5) Remove the tractor frame (L) ⑪ , tractor frame (R) ⑫, and sheet guide⑬ from the two shafts.

[Note on installation]

Adjust the projections ⑯ and ⑰ of the pin tractor wheel ⑭ and ⑮ on the tractor frame (L) and (R) so that the projections face the same direction. Then mount the frame on the drive shaft ③.



[On installation]

4.3.28 Sensor lever

(1) Remove the LF motor. (See 4.3.22.)

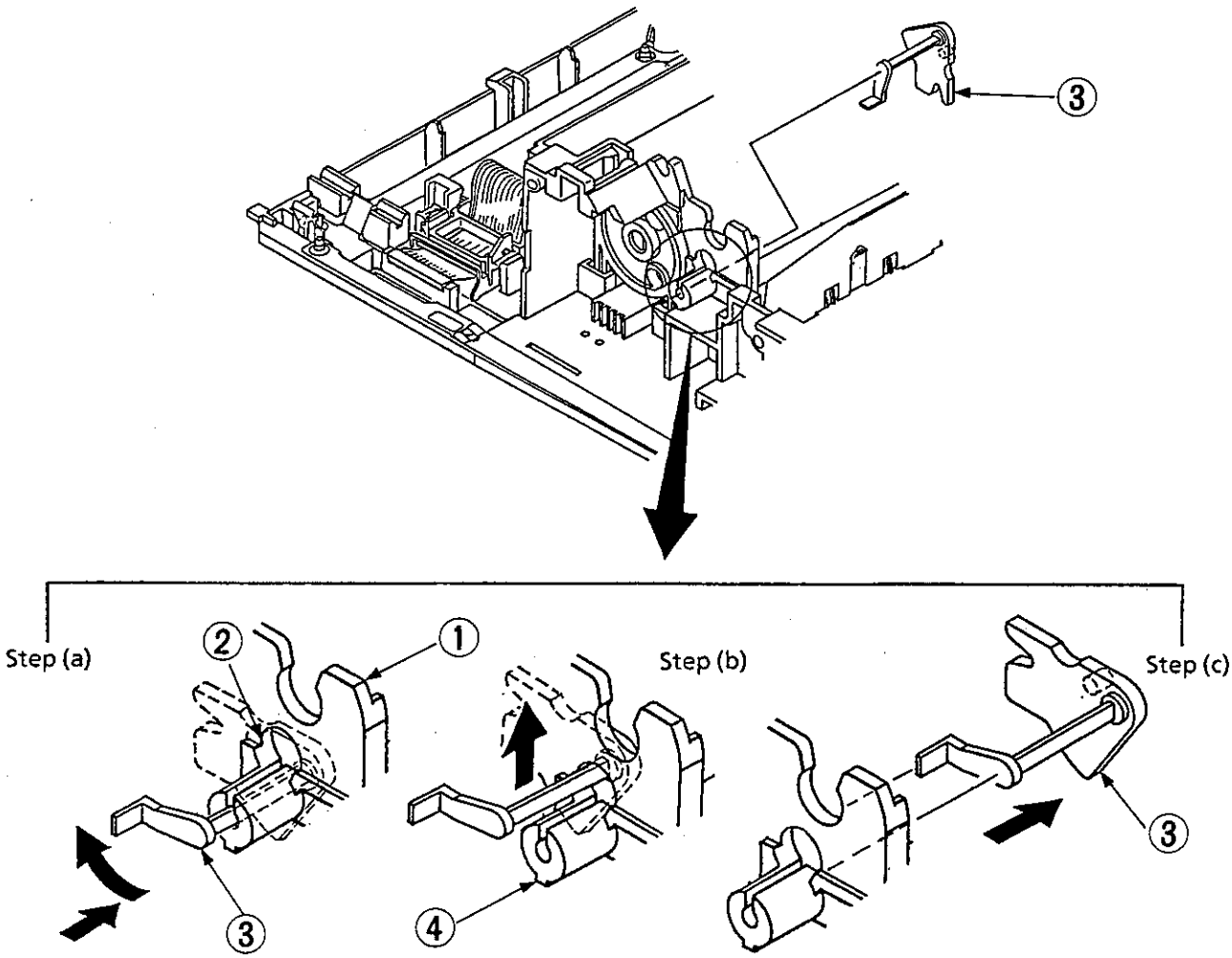
(2) Remove the tractor assembly. (See 4.3.27.)

(3) Remove the sensor lever ③ from the guide hole ② in the main frame ① as follows:

(a) Turn the sensor lever ③ 90° clockwise until it is horizontal.

(b) Remove the sensor lever ③ by lifting it upward from the shaft bearing ④.

(c) Remove the sensor lever from the guide hole ② in the main frame.

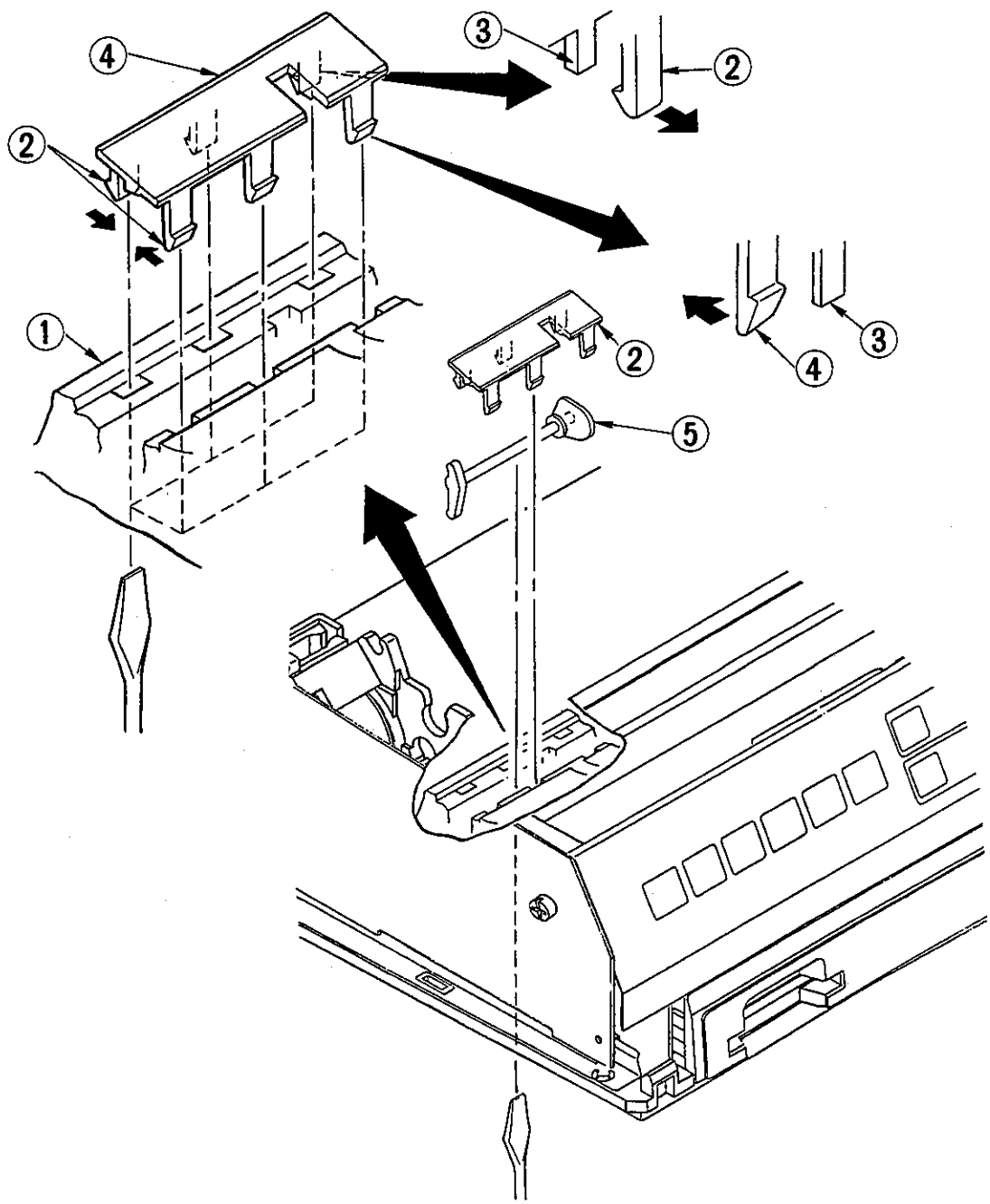


4.3.29 Paper end lever

(1) Remove the tractor assembly. (See 4.3.27.)

(2) Remove the six claws ② from the bottom side of the main frame ① guide ③ with a flat-blade screwdriver. Remove the sensor cover ④ by pulling it outward from the printer.

(3) Remove the paper end lever ⑤ from the main frame ①.



4.3.30 Leaf spring

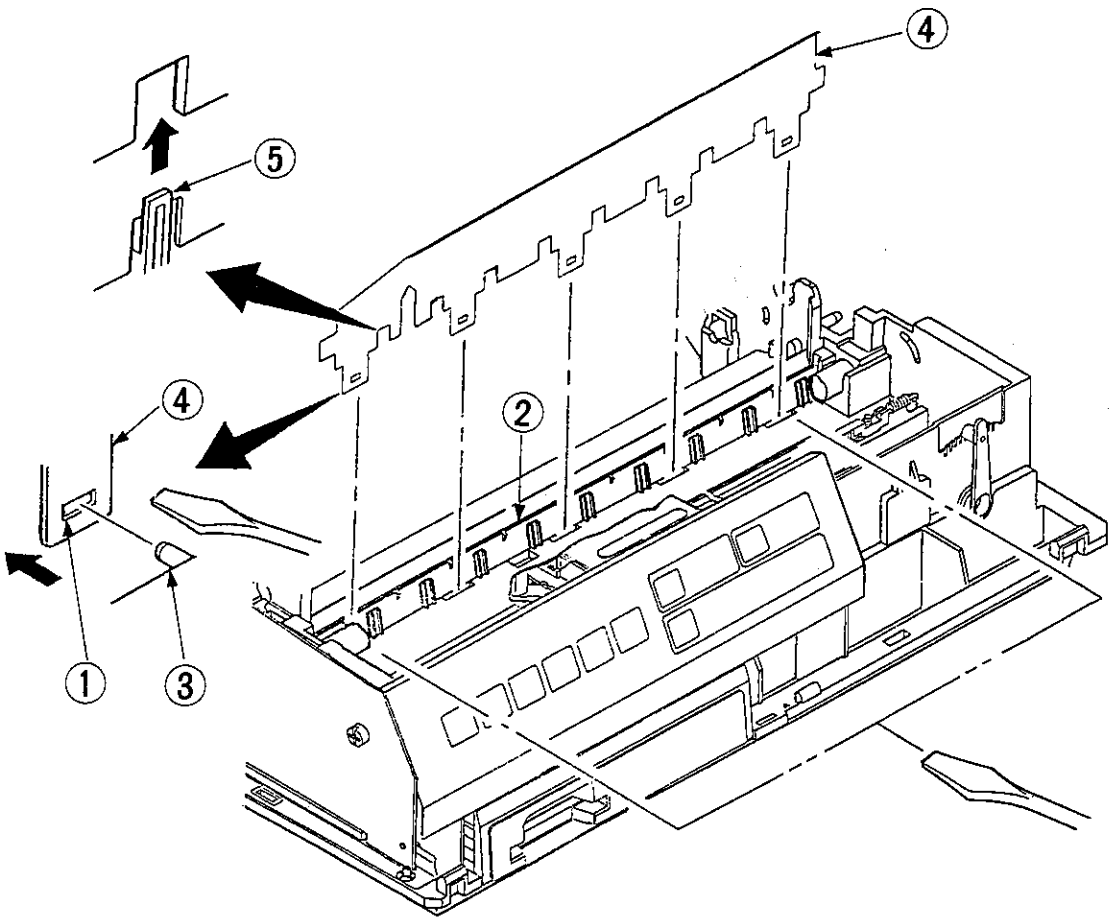
(1) Remove the platen assembly. (See 4.3.20.)

(2) Remove the coupling holes ① from the projections ③ on the main frame ② with a flat-blade screwdriver sequentially from left to right in order to remove the leaf spring ④.

[Note on installation]

Install the paper pressure guide so that it is fitted into the projections ③ and guide plates ⑤ simultaneously.

Coupling holes	:	ML390 Elite	5 points
		ML391 Elite	7 points
Guide plates	:	ML390 Elite	10 points
		ML391 Elite	15 points



5. ADJUSTMENT

5. ADJUSTMENT

5.1 Gap Between The Platen And Printhead

(1) Adjustment value : 0.016 ±0.002 inch (0.41 ±0.05 mm)

(2) Adjustment position : Perform in the left, center and right end of the platen.

(3) Adjustment method

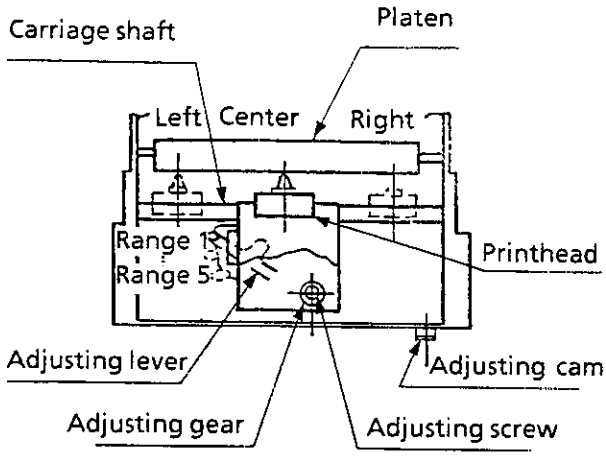
a) Push down the release lever to open.

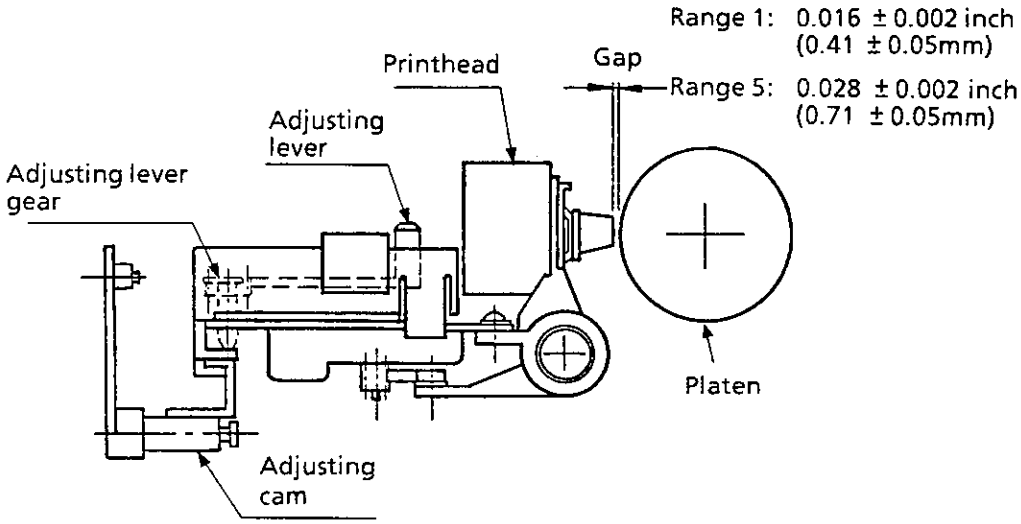
b) To compensate for the difference in gap between the right and left sides of the platen, turn the adjusting cam clockwise or counterclockwise to adjust gap.

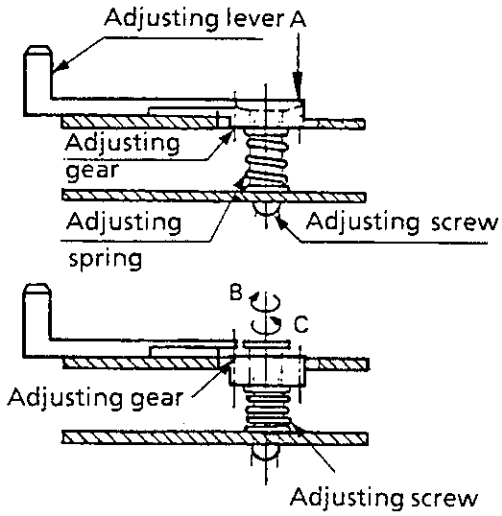
c) Set the adjusting lever to the range 1 position, press down the adjusting gear to the downward (A) direction to separate the adjusting lever from the adjusting gear.

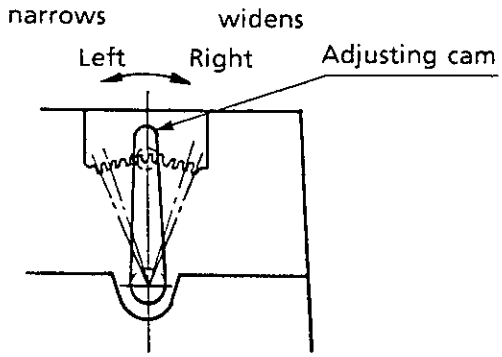
d) Adjust gap by turning the adjusting screw in the B or C direction.

e) Make sure that the gap is 0.028 ±0.002 inch (0.71 ±0.05 mm) with the adjusting lever at range 5.


Carriage shaft
Platen
Left
Center
Right
Range 1
Range 5
Printhead
Adjusting lever
Adjusting cam
Adjusting gear
Adjusting screw


Range 1: 0.016 ± 0.002 inch
(0.41 ± 0.05mm)
Range 5: 0.028 ± 0.002 inch
(0.71 ± 0.05mm)
Printhead
Gap
Adjusting lever
Adjusting lever gear
Platen
Adjusting cam


Adjusting lever A
Adjusting gear
Adjusting spring
Adjusting screw
B
C
Adjusting gear
Adjusting screw


narrows
widens
Left
Right
Adjusting cam

6. CLEANING AND LUBRICATION

6. CLEANING AND LUBRICATION

6.1 Cleaning

[Note] Before attempting to clean the printer turn off the POWER switch.

Clean the inside of the printer periodically according to the following items.

Cleaning period : Every 6 months of operation or 300 hours, whichever comes first.

Required time : About 10 min.

Tools to be used : Dry soft cloth (such as gauze, etc.), and vacuum cleaner (preferable.)

Cleaning area : In accordance with Table 6-1.

Table 6-1 Areas to be cleaned

Area to be cleaned	Contents of cleaning
Carriage shaft and its vicinity	Remove or vacuum out the paper particles and wipe out dirt, dust, and ribbon waste, etc.
Paper feed, pin surface	Clean the pin roller part of platen.
Paper end sensor	Wipe or vacuum out the dust which has stuck to the sensors.

6.2 Lubrication

(1) Lubricant

1) Alvania grease #2EP (or equivalent) ---- GEP

2) Pan motor oil (or equivalent) ---------- PM

(2) Amount of lubricant

1) ordinary ---------- Ⓐ : About 3 to 4 drops oil or 0.008 inch (0.2 mm) thick grease.

2) small amount ---- Ⓑ : About one drop of oil.

(3) Period of lubricant

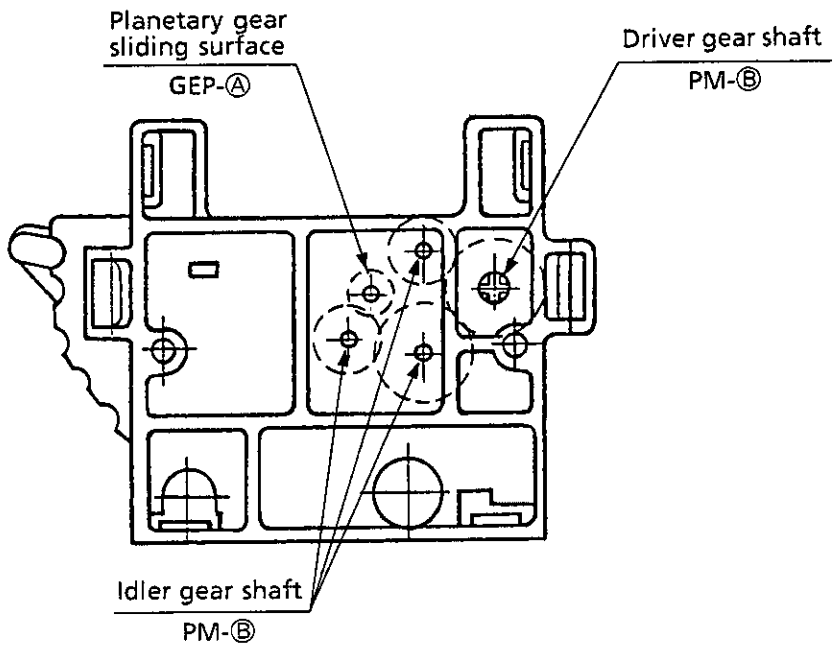
This equipment is designed to be maintenance-free and oiling is unnecessary during operation. However, when reassembly or cleaning of oiled parts occurs, lubricant is required.

(4) Areas to avoid contact with lubricant.

Item No.	Areas to avoid lubricant	Reason	Remarks
1	Platen surface	To prevent stained paper	
2	Pressure roller surface	To prevent stained paper and poor paper feeding	The roller surface should be free of oil because grease is applied to the pivotal part of the pressure roller.
3	Pressure roller for indicator assembly	To prevent stained paper and poor paper feeding	
4	Ink ribbon	To prevent poor printing	
5	Pin tractor	To prevent stained paper	
6	Flexible head cable	To prevent poor electrical contact and cable cracking	
7	Space motor board	To prevent poor electrical contact	

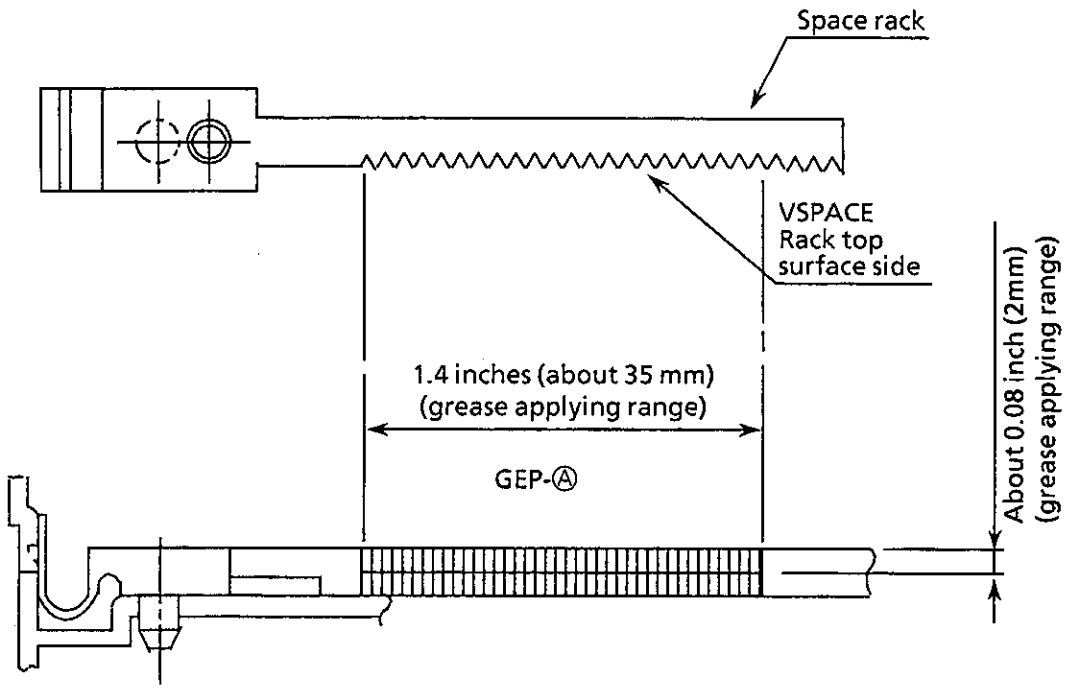
(5) lubrication points

a) Ribbon drive gear assembly



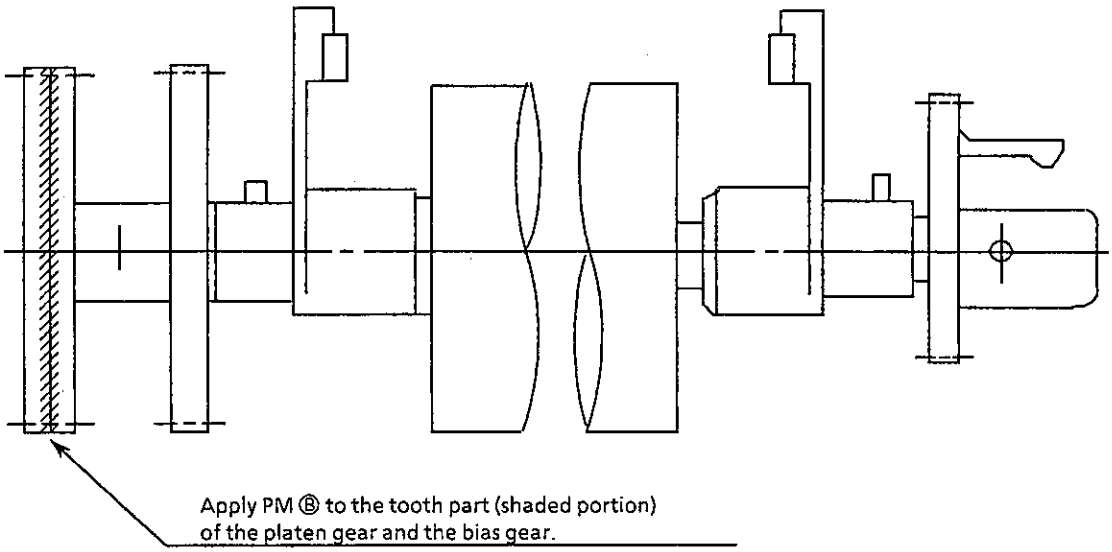
[Note] The upper and lower ends of the gear shaft should be oiled.

b) Space rack

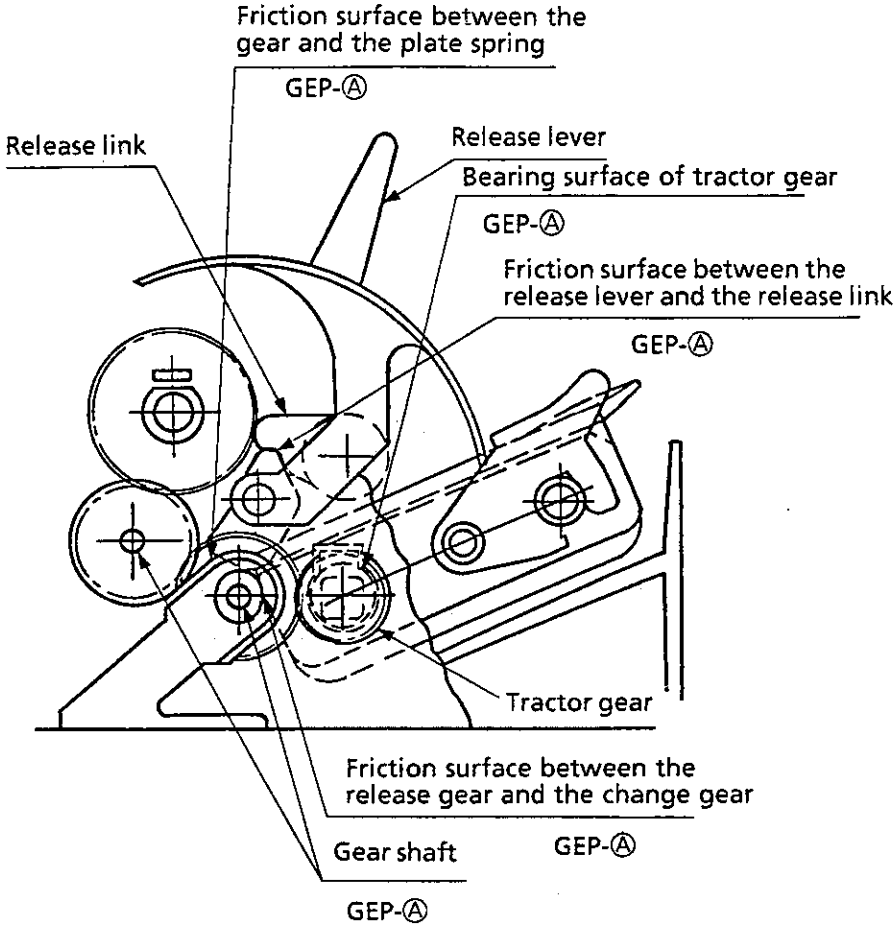


[Note] Grease should be applied to an area of about 1.4 inches (35 mm) from the left end of the tooth part (shaded portion) covering the edge about 0.08 inch (2mm) from the space rack top surface.

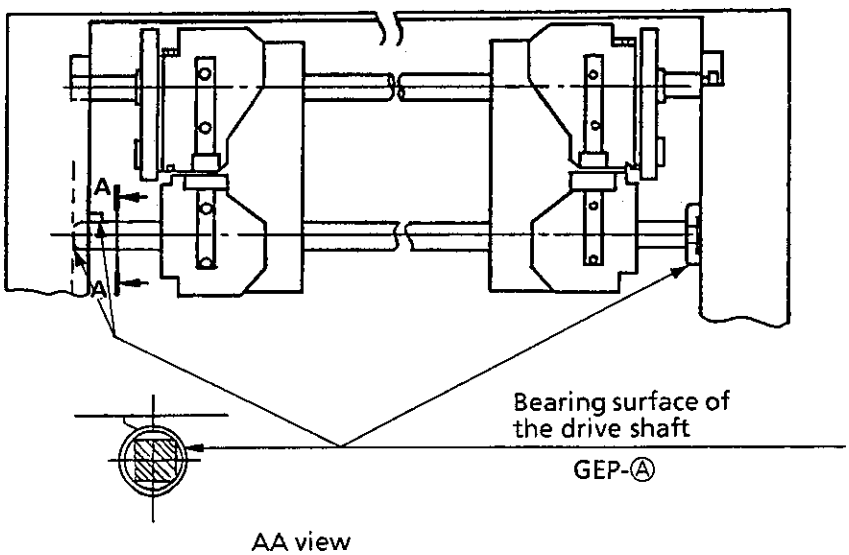
c) Platen assembly



d) Tractor driving system



e) Tractor drive shaft



AA view

7. TROUBLESHOOTING AND REPAIR

7. TROUBLESHOOTING AND REPAIR

7.1 Items to Check before Repair

Before servicing the printer, ask the customer if possible under what conditions the trouble occurred, and record the customer's responses.

Before troubleshooting, set up the printer to operate under the same conditions as at the time the trouble occurred and check whether the trouble is reproducible. If the trouble is not reproducible, perform the printer's self test and thoroughly test the printers functionality. If the trouble is reproducible proceed to the troubleshooting section.

7.2 Method of Troubleshooting

Verify the problem and then locate the trouble in according to the detailed procedure given for each item in Table 7-1.

Before correcting the problem, thoroughly read the precautions in Section 4.1.

The checkpoints for the SKRA board and the LXSP board are shown in Figures 7-1 and 7-2. The connector locations and pin numbers are shown in Figure 7-3.

Table 7-1

Status	Details	Flowchart item No.
Trouble upon power on	• Power is not supplied.	①
	• Spacing operation does not operate normally.	②
Trouble during printing operation	• Wrong character, character or dot omission	③
	• Line feed trouble	④
	• Malfunction of switch on operation panel	⑤
	• Data receiving failure	⑥

7.3 Lamp Display

(1) Printer mode display

(2) Fault alarm display

When the printer detects a variety of alarm conditions, these alarm conditions are displayed using LEDs. Alarm condition status is displayed by the different MODE LEDs which are lit along with the POW LED and the flashing ALM LED.

The details are listed below.

Table 7-2

Printer mode		ALARM	SELECT	Contents	Remarks
Normal operation mode	ON LINE	OFF	ON	Indicates that the printer is ready toreceive data and print.	
	HEX DUMP mode			Indicates that the printer is in hex dump mode.	
	LOCAL mode	OFF	OFF	Indicates that the printer is in local mode.	
	MENU mode	OFF	OFF	Indicates that the printer is in menu mode.	
Operator alarm condition	Paper end	ON	OFF	Form end, single sheet end, or bottom paper end	
	Paper jam			SASF paper jam	
	CSF paper jam			Paper jam or paper end, when CSF is installed	
	Print suppress	OFF	BLINK	Indicates that the printer is in the print suppress mode.	
Internal fault alarm condition		BLINK	OFF		

Table 7-3

Error condition	Lit mode LED besides POW and flashing ALM LED	Contents
Memory error	10, COURIER	MPU internal RAM error
	12, COURIER	Program ROM error
	12, ROMAN	EEPROM error
	15, COURIER	External RAM error
	12, HELVETTE	Resident CG error
	20, HELVETTE	Resident CG release
Cartridge error	12, BOLD	Cartridge CG error
	20, BOLD	Cartridge CG release
Spacing error	17, COURIER	HEAD HOMING error
	17, ROMAN	Spacing error

Table 7-4

Alarm	LEDs				Comment
	Primary Message			Detail Message	
	Menu	ALARM	SEL		
Paper out	Current mode	ON	OFF	Current CPI	alarm occurs 1" from bottom edge
Printed Temp	BLINK	OFF	ON	Current CPI	after cool down, continues to print

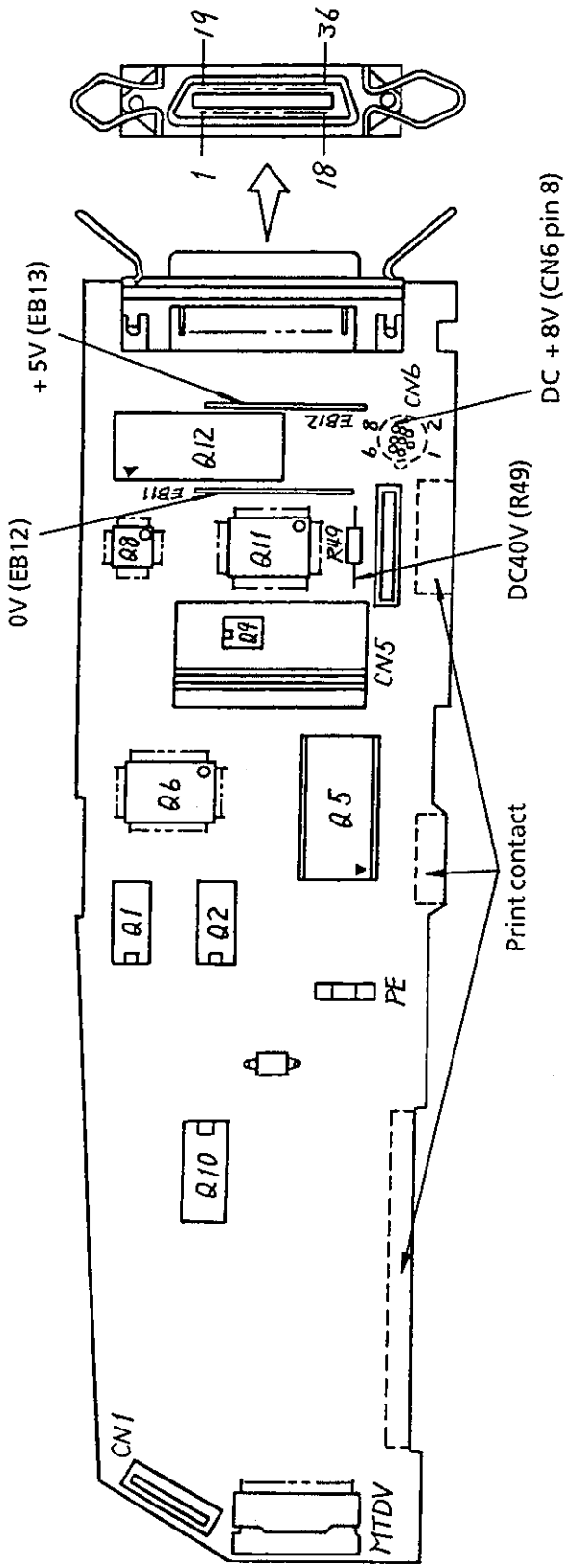
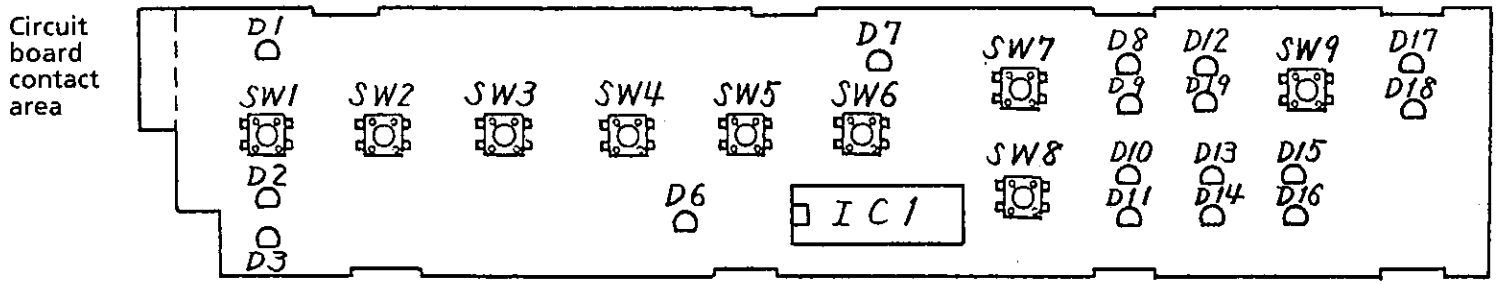


Figure 7-1 Check points on the control printed circuit board (SKRA Rev.11)

LXSP printed circuit board

SW1 ... SEL
SW2 ... MODE or EXIT
SW3 ... LING FEED or GROUP
SW4 ... FORM FEED or ITEM
SW5 ... PAPER PARK or SET
SW6 ... TOF/QUITE or PRINT
SW7 ... FONT
SW8 ... CHARACTER PITCH
SW9 ... PRINT QUALITY

Solering side



D1 ... SEL
D2 ... ALARM
D3 ... POWER
D6 ... MENU
D7 ... QUIET
D8 ... COURIER
D9 ... HELVETTE
D10 ... 10
D11 ... 17
D12 ... ROMAN
D13 ... 12
D14 ... 20
D15 ... 15
D16 ... PROP
D17 ... LQ
D18 ... UTL
D19 ... BOLD

Figure 7-2 Check points on the operation panel printed circuit board

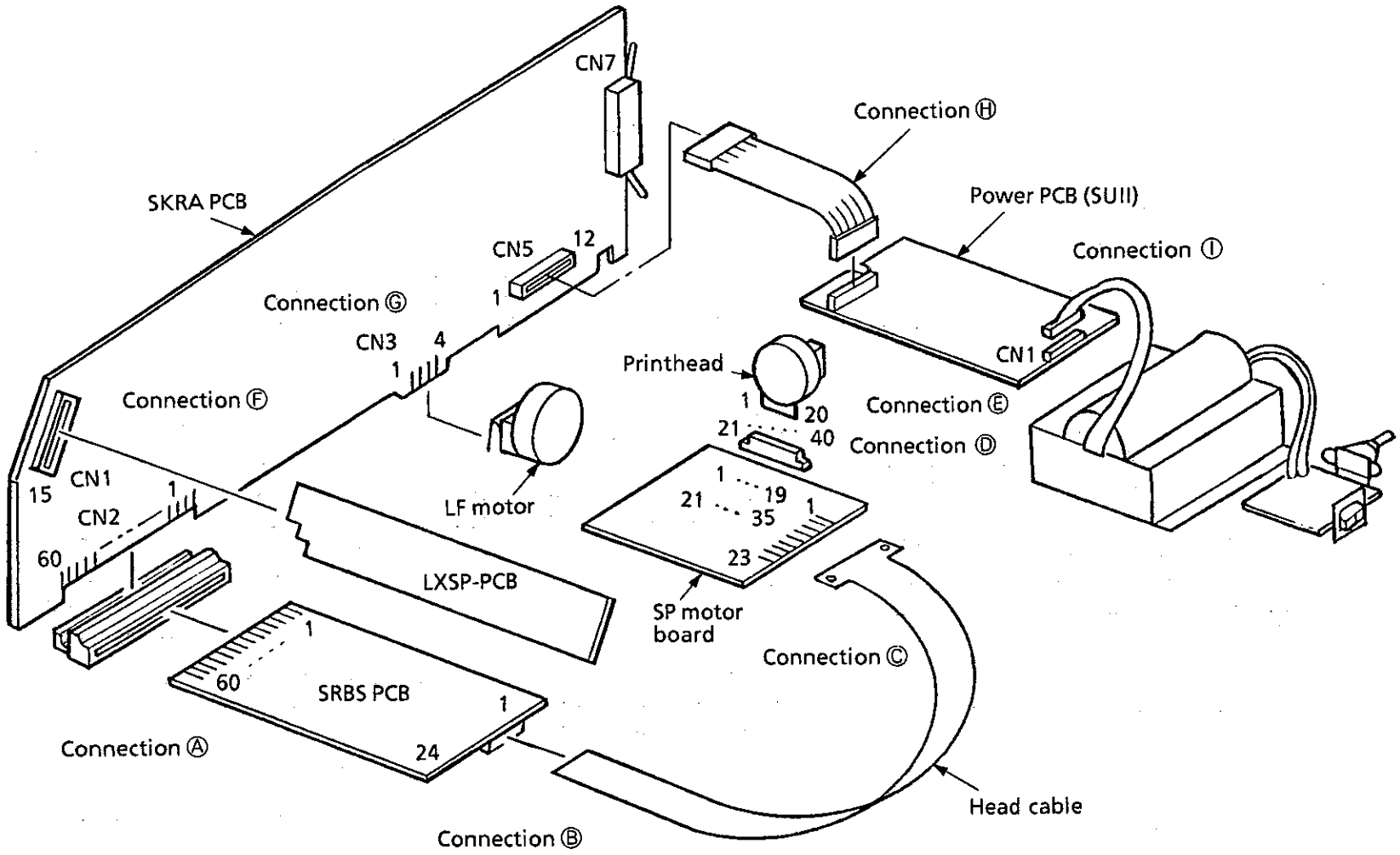
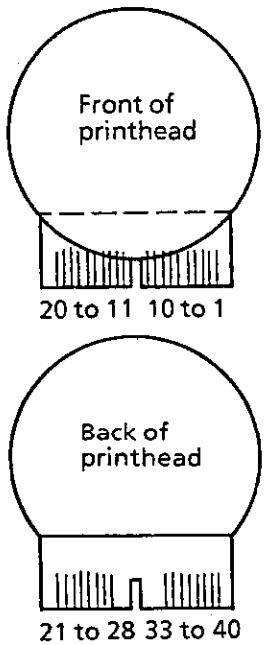
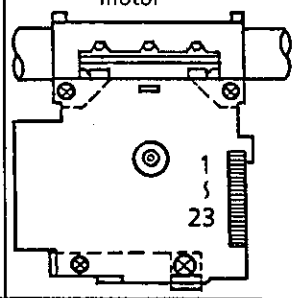
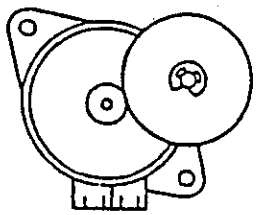


Figure 7-3 Connection locations and pin numbers

Table 7-5 Pin Numbers and signal names

Name	Signal name	Connection					Coil resis-tance	Figure
		A	B	C	D	E		
PRINT-HEAD	ODD EN	2,3	13,15	13			Approx. 18.3Ω	Contact on the printhead
	EVEN EN	2,3	13,15	15				
	HEAD CAP	7	2	2				
	ODD COMMON	8-12	3-6	5.6	14,15 30,31			
	EVEN COMMON			3,4	6,7, 26,27			
	TSD	14	10	10	20			
	S CLOCK	15	11	11				
	S DATA	17	14	14				
	+40V FB	1	23	22				
	OV	16	12	12				
	+5V	18	16	16	26			
	EP	21-25	19-22	19-22				
	#1				19	19		
	#2				2	2		
	#3				18	18		
	#4				3	3		
	#5				35	39		
	#6				22	22		
	#7				34	38		
	#8				23	23		
	#9				17	17		
	#10				4	4		
	#11				16	16		
	#12				5	5		
	#13				33	33		
	#14				24	24		
	#15				32	32		
	#16				25	25		
	#17				13	13		
	#18				8	8		
	#19				12	12		
	#20				9	9		
	#21				11	11		
	#22				10	10		
	#23				29	29		
	#24				28	28		



Name	Signal name	Connection						Coil resis-tance	Figure
		A	B	C	F	G	H		
SP MOTOR	V	5	7	7				Approx. 21Ω	Contacts on the SP motor 
	U	13	8	8					
	W	4	9	9					
	ØA	20	18	18					
	ØB	19	17	17					
OPERA-TION PANEL	SEL SW				3				
	MODE SW				4				
	LF SW				5				
	FF SW				6				
	PARK SW				7				
	TOF SW				13				
	PRINT SW				10				
	FONT SW				11				
	CHAR SW				12				
	LAMP SD CLK				14				
	LAMP SD				2				
	+5V				1,15				
	OV				8,9				
LF MOTOR	Ø1					2		Approx. 6.8Ω	Contacts on the LF motor 
						1			
	Ø2					3			
						4			
CNS	+40V						1,3		
	EP						4,5		
	+5V						6,7		
	OV						8,9		
	+8V						10		
	AC 10V						11		
	ALM						12		

① No power

- Are AC cables connected correctly?

YES / NO

- Connect the AC cables correctly.

- Is the AC fuse open on the primary side of the filter assembly?

NO / YES

- Replace the fuse.

- Are + 5V and + 40V supplied to the control board?

+ 5V : Measurement can be taken between EB13 and EB12 (control board).

+ 40V : Measurement can be taken between R49 and EB12 (control board).

YES / NO

- Is the fuse F1 open on the power supply board?

NO / YES

- Replace fuse F1.

- Is the connector cord connected to CN5 (control board) or CN2 (power supply board) correctly? (connection Ⓗ part)

YES / NO

- Connect the connector cord to CN5 (control board) or CN2 (power supply board) correctly.

- Replace the power supply board.

- Replace the control board.

② Space operation does not operate normally

- Is the carriage assembly moving erratic or jammed?

YES

NO

- Check around the carriage assembly and space motor and repair the mechanism.

- Are +5V and +40V supplied to the control board?

YES

NO

- Is the connector cord connected to CN5 (control board) or CN2 (power supply board) correctly? (connection Ⓗ part)

NO

YES

- Replace the power supply board.

- Connect the connector cord to CN5 (control board) or CN2 (power supply board) correctly.

- Is CN2 contact connection normal? (connection Ⓐ part)

YES

NO

- Reset the control board.

- Replace the control board.

- Is condition corrected?

YES

NO

- Replace the space motor.

- END

③ Wrong character, character or dot omission

- Is CN2 (connection Ⓐ part) contact connection normal?

YES

NO

- Reset the control board.

- Is the head cable inserted into CN1 of the SRBS board correctly? (connection Ⓑ part)

YES

NO

- Reset the head cable to CN1 correctly. (connection Ⓑ part)

- Replace the printhead.

- Is condition corrected?

YES

NO

- Replace the control board.

- Is condition corrected?

NO

YES

- END

- Is the space motor board contact normal? (connection © part)

NO

YES

- Reset the head cable.

- Replace the space motor.

- END

④ Line feed trouble

- Rotate the platen knob.
- Does the platen rotate smoothly?

YES / NO

- Pull the release lever to the open position (front of printer).
- Does the platen rotate smoothly?

NO / YES

- Reinstall paper
- Ensure no foreign matter or dust is present on the platen gear, idler gear or drive gear.
- Ensure smooth meshing of the platen gear, idler gear and drive gear.
- Ensure correct operation of the push tractor assembly (R) or (L). (See Section 4.3.27.)
- Replace the push tractor assembly (R) or (L). (See Section 4.3.27.)

- Is LF motor interconnect module from LF motor connected with control board correctly?

YES / NO

- Reset the control board

- Is LF motor interconnect module from the control board connected with LF motor correctly?

YES / NO

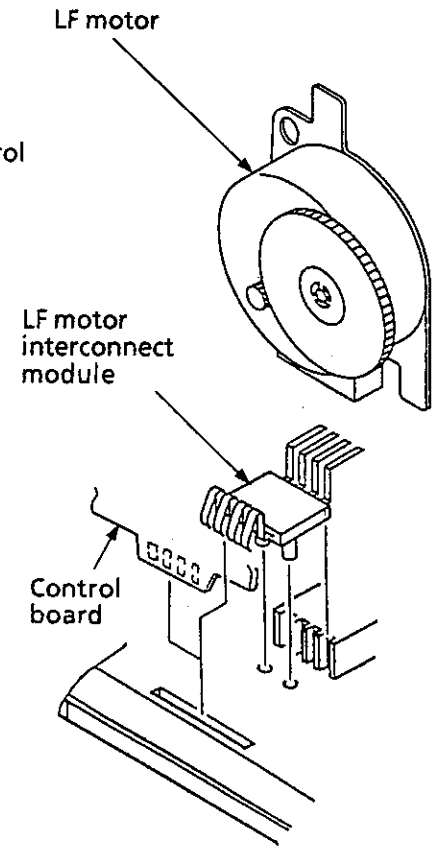
- Connect it correctly.

- Replace the control board. **(See Section 4.3.4)**
- Remedied?

YES / NO

- Replace the LF motor. (See Section 4.3.22)

- END



⑤ Malfunction of switch on operation board

- Is the operator board inserted into CN1 correctly? (connection Ⓕ part)

YES

- Replace the operator board.
- Is condition corrected?

NO

- Connect it correctly.

YES

- END

NO

- Replace the control board.

⑥ Data receiving failure

- Is the SELECT lamp on?

YES

- Is the interface cable connected correctly?

NO

- Set to SELECT mode.

YES

- Replace the control board.

NO

- Connect it correctly.

APPENDICES

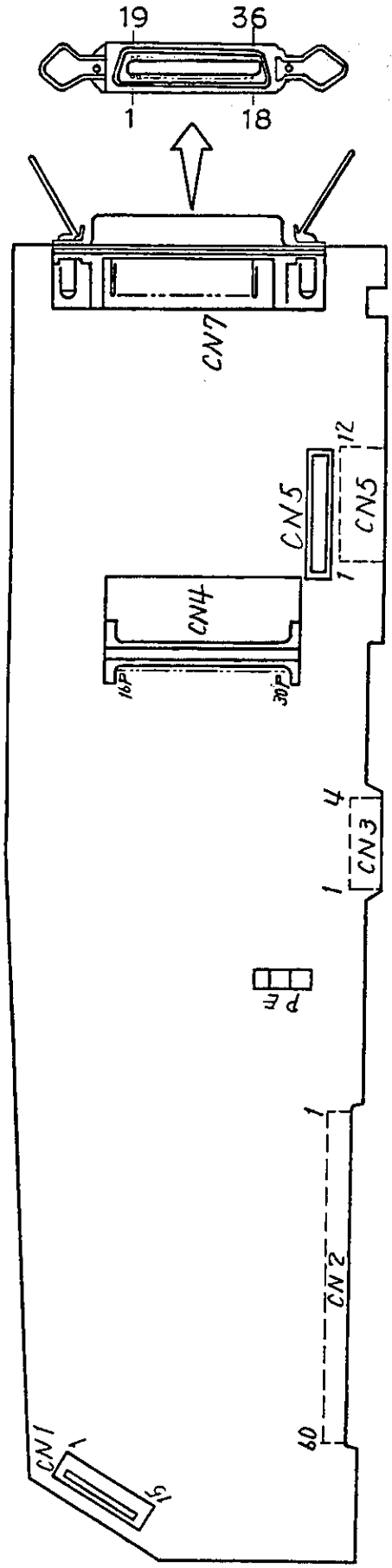
APPENDIX A PCB LAYOUT

(1) SKRA-PCB (control board)

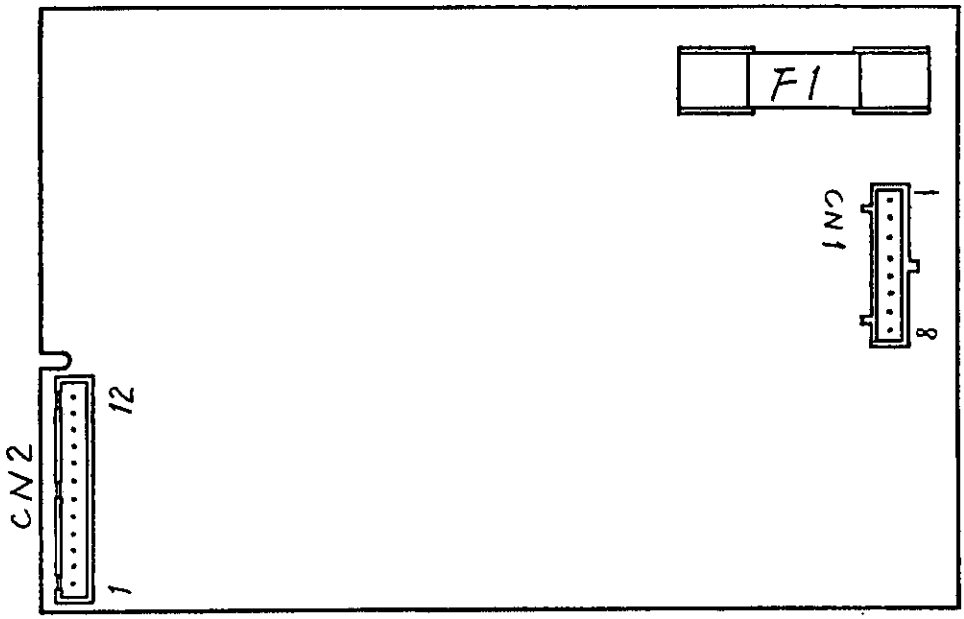
(2) SUII-PCB (power board)

(3) LXSP-PCB (operator panel board)

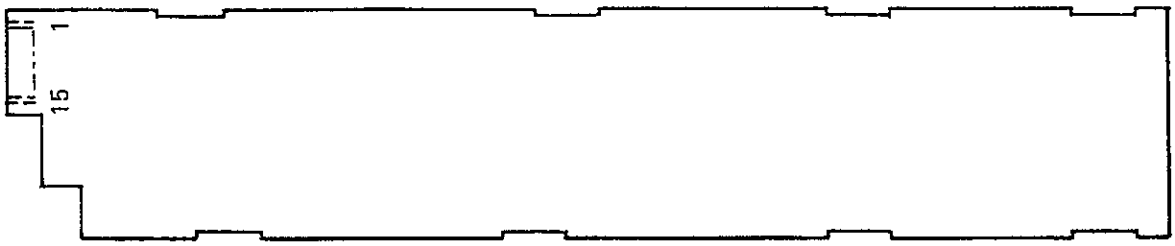
(4) SRBS-PCB (connection board)



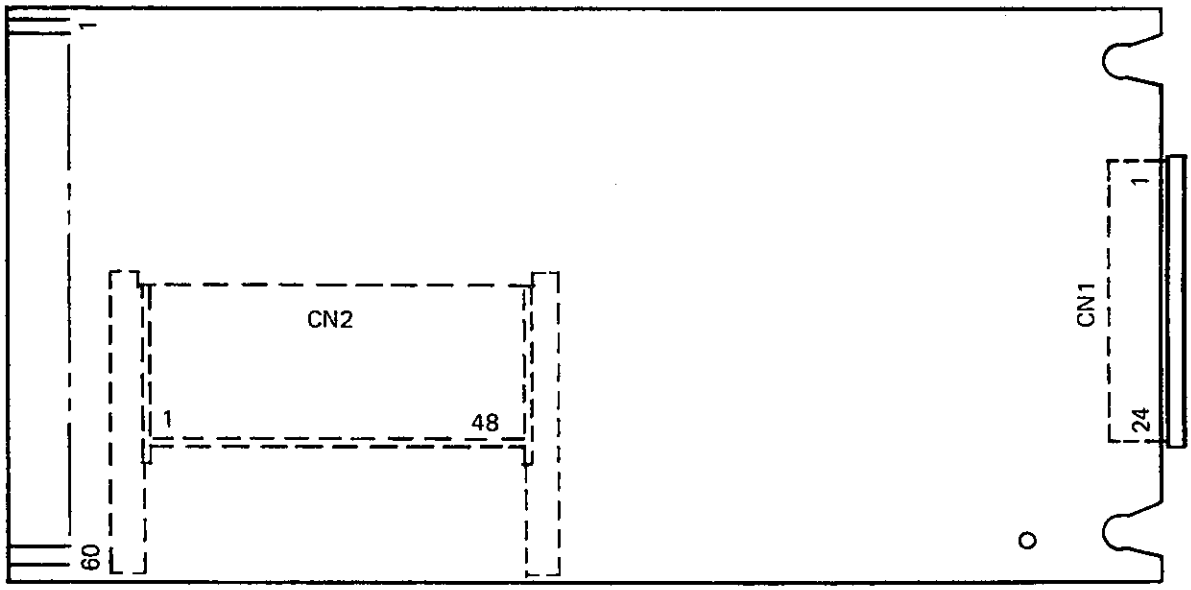
SKRA PCB (control board) (Rev. 10 and Rev. 11)



SUII-PCB (power board) (CN2)



LXSP-PCB (operator panel board)



SRBS-PCB (connection board)

APPENDIX B SIGNAL LIST

Signal abbreviation	Signal name	Function
0V	Signal Ground	Ground for logic circuits
+ 5V	+ 5 volt	Power supply for logic circuits
+ 8V	+ 8 volt	Power supply for linear circuits
+ 40V	+ 40 volt	Power supply for drive circuits
AD0 - AD7	Address Data Signal	80C154 address/data bus signal
A7-P - A0-P	Address Bus	80C154 address bus signal
A15 - A8	Address Bus Signal	80C154 address bus signal
A16	Address Signal	Address signal
AC10V	AC 10 Volt	Power supply for RS-232C interface + 9 V
ACK-N	Acknowledge	Centronics I/F signal Signal which indicates that input of data has been completed.
AUTO FEED-N	Automatic Paper Feed Signal	Centronics interface signal. When this signal is active, line feed is performed after printout. (However, this signal is effective only for printers set for EPSON emulation.)
BAT LOW-N	Battery Low	Signal which indicates that the battery voltage of optional FONT card has dropped abnormally.
BAT SIG	Battery Signal	Output signal of optional FONT card battery
BUSY-P	Busy	Centronics I/F signal for indicating that the printer is busy.
CAS1-N	Column Address Strobe	Signal for strobing a column address to the D-RAM
CAS2-N	Column Address Strobe	Signal for strobing a column address to the D-RAM
CD	Carrier Detect	RS-232C interface signal which indicates that the host side is sending data.
CHAR SW-N	Character Pitch Switch Signal	Signal which indicates that the switch for selecting print pitch for 10, 12 and so forth has been pressed.

[Note] "-N" in signal abbreviation denotes signal is active in low state.
"-P" in signal abbreviation denotes signal is active in high state.

Signal abbreviation	Signal name	Function
CLK	CLOCK	Timing shift clock for reading/writing EEPROM data
CLOCK-N	CLOCK	Clock signal of the CPU (Not used)
CLOCK-P	CLOCK	Clock signal of the CPU
COM-P	Common	Odd/Even common line of the power supply for driving the head
CS	Chip Select	Signal for selecting EEPROM chip
CS1N	Chip Select 1	Chip select signal which is output from the LSI chip (79H097)
CS3N	Chip Select 3	Chip select signal which is output from the LSI chip (79H097)
CS12N	Chip Select 12	Chip select signal which is output from the LSI chip (79H097)
CSF COMMD1	Cut-Sheet Feeder Command 1	CSF I/F signal Operation instruction signal 1
CSF COMMD2	Cut-Sheet Feeder Command 2	CSF I/F signal Operation instruction signal 2
CSF CONNECT-N	Cut-Sheet Feeder Connect Signal	CSF interface signal Indicates that CSF is connected.
CTS	Clear to Send	RS-232C interface signal Indicates that the host side is ready.
DATA1-DATA8	DATA	Centronics I/F Signals for receiving data
DATA IN	Data In	Data signal for writing to EEPROM
DATA OUT	Data Out	Signal to output data from EEPROM
DB0 - DB7	Data Bit	Signal bus for transferring data between the printer control section and the RS-232C interface control section
D-RAMA7 - D-RAMA0	D-RAM Address	Address bus signal for the D-RAM
DSR	Data Set Ready	RS-232C interface signal which indicates that the host side has completed the preparations for sending data.
DTR	Data Terminal Ready	RS-232C interface signal Indicating printer is ready.

Signal abbreviation	Signal name	Function
EN-N	Enable	Signal enabling the operation of ICs for driving head pins.
EP	Power Ground	Drive circuit system ground.
EVEN COM-P	Even Common	Drive circuit power supply line to stagger even head pins.
EVEN EN-N	Even Enable	Signal enabling the ICs for driving even head pins.
FAULT-N	Fault Signal	Centronics I/F signal for displaying alarm state of a printer.
FFSW-N	Form Feed Switch Signal	Signal which indicates that FF switch has been pressed.
FG	Frame Ground	Chassis ground.
FONT SW-N	Font Switch Signal	Signal which indicates that the switch for selecting resident or cartridge font has been pressed.
HD ALM-P	Head Alarm	Signal for detecting an abnormality in the head drive circuit.
HD DV-N	Head Drive	Head drive control signal.
HD OFF1-N	Head Drive off 1	Signal for cutting off the head drive circuit.
HD OFF2-N	Head Drive off 2	Signal for cutting off the head drive circuit.
HEAD GAP-N	Head Gap signal	Signal which indicates that the head gap is set to range "5".
HEAD TEMP-N	Head Temperature	Signal which indicates that the head temperature has risen above the specified normal value.
I-PRIME-N	Input Prime	Centronics I/F signal for initializing the printer.
IC CARD-N	IC Card	Signal which indicates that an optional IC card is installed.
IF DATA8 - IF DATA1	Interface Data	Data received via the centronics and RS-232C interface.
IFRD-N	Interface Read	Timing signal for the RS-232C interface control section to read data from the printer control section.
IPT-N	Interrupt	Interrupt signal to 80C154.
LAMP SD	Lamp Send Data	Serial data to light/extinguish LEDs on the operator panel.

Signal abbreviation	Signal name	Function
LAMP SD CLK	Lamp Send Data Clock	Shift clock for serial data to light/extinguish LEDs on the operator panel.
LFOVD-P	Line Feed Over Drive	Signal for controlling slice levels of LF motor driving currents.
LFDA	Line Feed Digital Signal A	LF motor drive current control signal A.
LFDB	Line Feed Digital Signal B	LF motor drive current control signal B.
LF HOLD-N	Line Feed Motor Hold	Signal to change the slice level while LF motor is in the hold mode.
LF PHA	Line Feed Phase A	LF motor phase reversing signal A.
LF PHB	Line Feed Phase B	LF motor phase reversign signal B.
LF SW-N	Line Feed Switch Signal	Signal which indicates that LF switch has been pressed.
LSI BUSY-N	LSI Busy	Signal which indicates that serial data is being transferred to the LSI chip (MSM79H097). (Not used)
MODE SW-N	Mode Switch Signal	Signal which indicates that the mode switch for selecting PRINT/MENU has been pressed.
ODD COM-P	ODD Common	Drive circuit power supply line to stagger ODD head pins.
ODD EN-N	ODD Enable	Signal for enabling the ICs for driving ODD head pins.
PAPER END-N	Paper End	Signal indicating out of paper condition.
PARK SW-N	Parking Switch Signal	Signal which indicates that a park switch has been pressed.
PE-P	Paper End	Centronics I/F signal which indicates that the printer is in the paper end state.
PHASE A-P	Phase Signal A	Space motor phase A encoder output signal.
PHASE B-P	Phase Signal B	Space motor phase B encoder output signal.
PRINT SW-N	Print Quality Switch Signal	Signal which indicates that the switch for specifying utility or letter quality mode has been pressed.
PSEN-N	Program Store Enable	Timing signal for 80C154 to load an external program.
RxD	Receive Data	RS-232C interface Reception signal line.

Signal abbreviation	Signal name	Function
RxDATA-N	Receive Data	Signal which indicates data reception by centronics or RS-232C interface.
RAD7 - RAD0	RAM Address Data	Data bus signal of the memory which is connected to the LSI chip. (79H097)
RAM OE-N	RAM Output Enable	D-RAM data output valid signal.
RAM WR-N	RAM Write	Signal for writing data to the D-RAM.
RAS-N	Row Address Strobe	Row address strobe signal to D-RAM.
RD-N	Read	Read signal from the CPU (80C154).
RET-SG	Return Signal Ground	Centronics I/F Return ground for centronics I/F signal line.
ROM A15-P- ROM A0-P	ROM Address	CG ROM address bus signal.
ROM READ-N	ROM Read	Signal for reading data from the CG ROM which is connected to the LSI chip. (79H097)
RST IN	Reset In	RS-232C interface circuit initialize signal.
RST OUT 1	Reset Out	Printer initialize signal.
RST OUT-P	Reset Out	Printer initialize signal.
RTS	Request to Send	RS-232C interface Sending request signal.
S-CLOCK-N	Serial Shift Clock	Shift clock for latching print head serial data to a shift register.
S DATA-N	Serial Send Data	Serial data for print head shift register.
S-I/F ON-N	Serial Interface On	Control signal for handshake between the print control section and the RS-232C interface control section.
S-I/F RST	Serial Interface Reset	Signal for soft resetting the RS-232C interface control section.
SASF-N	Semi Automatic Sheet Feeder	Signal to indicate bail arm level open or close position.
SEL SW-N	Select Switch Signal	Signal which indicates SEL switch has been pressed.
SELECT-P	Select	Centronics I/F signal which indicates that the printer is ready to receive data.
SG	Signal Ground	Ground for logic circuits.

Signal abbreviation	Signal name	Function
SLCTIN-N	Select In	Centronics interface signal which controls validity/invalidity of DC1/DC3 signal. (However, this signal is effective only for printers set for EPSON emulation.)
SP ON/OFF	Space On-Off Signal	Signal for controlling slice levels of DC space motor driving current.
SPALM-P	Space Alarm	Signal for detecting an abnormality in the drive circuit of the space motor.
SPDA-P	Space Digital-Analog Signal	Signal for controlling DC space motor drive current.
SPMU	Space Motor-U	
SPMV	Space Motor-V	Analog phase signals of the DC space motor.
SPMW	Space Motor-W	
SPU-P	Space U	
SPV-P	Space V	Digital phase signals of the DC space motor.
SPW-P	Space W	
SSD	Supervisory Send Data	RS-232C interface signal to indicate Reception enable state.
STAGER END	Stagger Buffer End	Signal which indicates DMA transfer of print data to the stagger buffer of the LSI chip (79H097) is completed.
STROBE-N	Data Strobe	Centronics interface Timing signal for making the printer receive data.
TxD	Transmit Data	RS-232C interface Transmission signal line.
TOF SW-N	Top of Form Switch signal	Signal which indicates that the TOF switch has been pressed.
TSD-N	Thermal Shut Down	Output signal that indicates that the temperature of the head has exceeded the specified temperature value.
WR-N	Write	Write signal from the CPU (80C154).
WR PROTECT	Write Protect	Signal which inhibits writing to an optional FONT card.

APPENDIX C CIRCUIT DIAGRAM

Table C-1 shows the meanings of symbols used in the circuit diagrams and Figure C-1 (1) to C-2 (2) shows the circuit diagrams.

Table C-1 Table of symbols

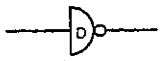
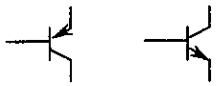
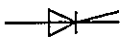
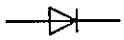
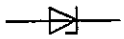
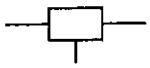
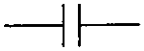
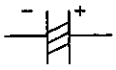
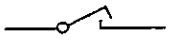
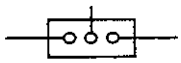
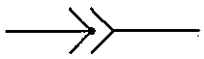
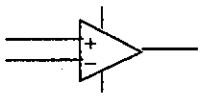
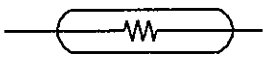
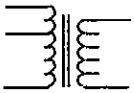
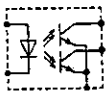
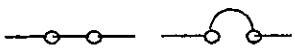
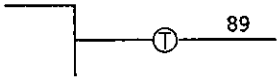
Symbol	Mark	Details
	Q	SN74LS06 Inverter (open collector)
	OSC	Ceramic oscillator
	TR	Transistor
	SCR	Thyristor
	D	Diode
	D	Zener diode
	D	Light-emitting diode
	REG	Regulator
	C	Capacitor
	C	Electrolytic capacitor
	R	Resistor
	SW	Switch

Table C-1 (cont'd)

Symbol	Mark	Details
	SP	Jumper wire or plug
	CN	Connector (terminal)
(Reference)		Means a single part
		Dot head (element)
	FG	Frame ground
	L	Coil
	Q	Comparator
	THERMISTOR	Themistor
	SG	Signal ground
	TF	Transformer
		Photo sensor
	F	Fuse
	S, J	Jumper wire
		Check terminal

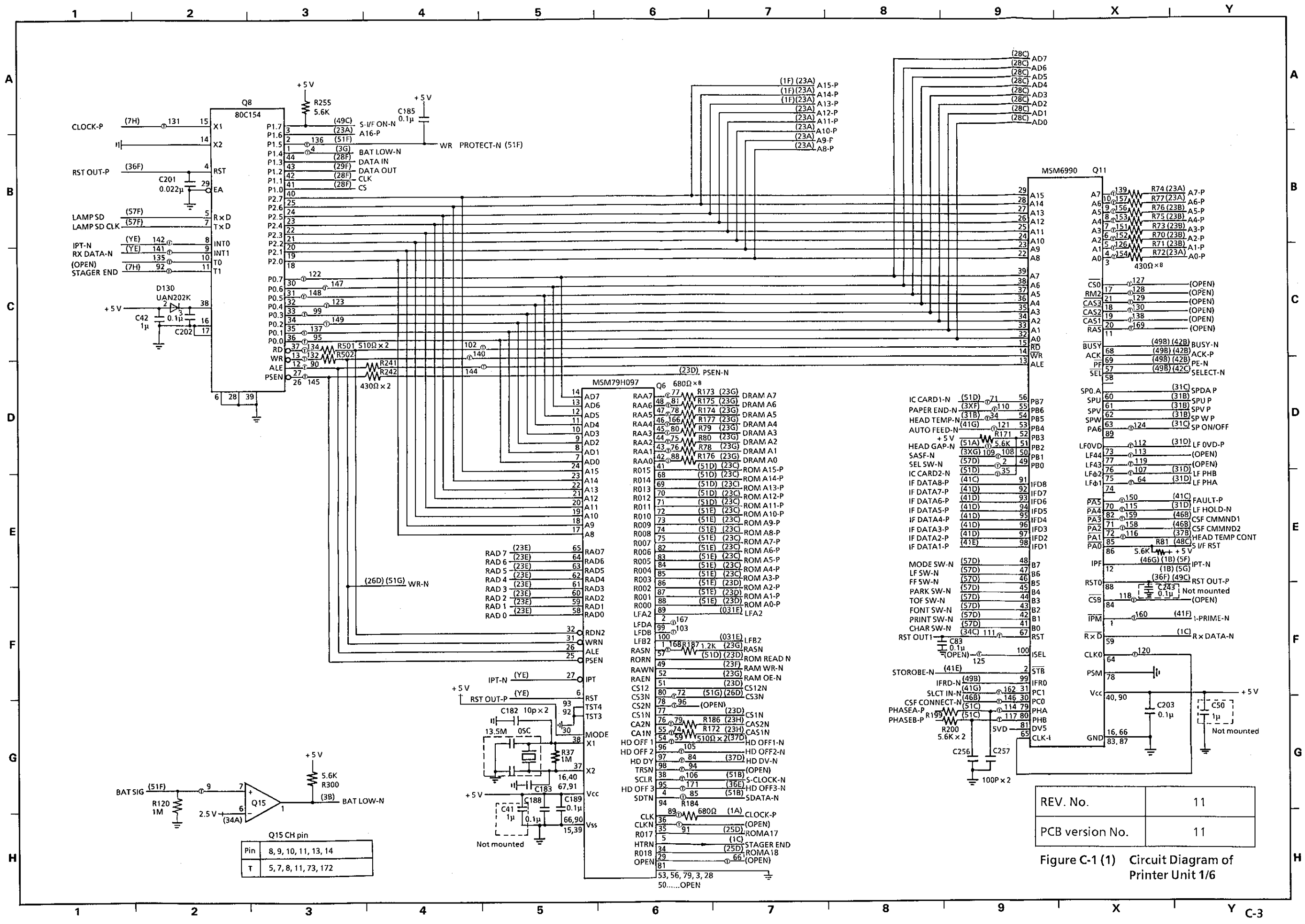


Figure C-1 (1) Circuit Diagram of Printer Unit 1/6

CG ROM (Q5)	SP1	SP5	SP6
512K EP	A	B	B
1M MASK	B	B	B
1M EP	A	B	B
4M MASK	A	A	A
4M EP	A	A	A

Pin Assign

	27010	27512	27256		
VPP	—	—	1	32	Vcc
A16	—	—	2	31	PGM
A15	A15	Vpp	3 (1)	(28)30	Vcc
A12	A12	A12	4 (2)	(27)29	A14
A7	A7	A7	5 (3)	(26)28	A13
A6	A6	A6	6 (4)	(25)27	A8
A5	A5	A5	7 (5)	(24)26	A9
A4	A4	A4	8 (6)	(23)25	A11
A3	A3	A3	9 (7)	(22)24	OE
A2	A2	A2	10 (8)	(21)23	A10
A1	A1	A1	11 (9)	(20)22	CE
A0	A0	A0	12 (10)	(19)21	D7
D0	D0	D0	13 (11)	(18)20	D6
D1	D1	D1	14 (12)	(17)19	D5
D2	D2	D2	15 (13)	(16)18	D4
GND	GND	GND	16 (14)	(15)17	D3

—	—	—	—	—	Vcc
—	—	—	—	—	PGM
Vcc	Vcc	NC	0V	0V	0V
A14	A14	A14	A14	A14	A14
A13	A13	A13	A13	A13	A13
A8	A8	A8	A8	A8	A8
A9	A9	A9	A9	A9	A9
A11	A11	A11	A11	A11	A11
OE/Vpp	OE	OE	OE	OE	OE
A10	A10	A10	A10	A10	A10
CE	CE	CE	CE	CE	CE
D7	D7	D7	D7	D7	D7
D6	D6	D6	D6	D6	D6
D5	D5	D5	D5	D5	D5
D4	D4	D4	D4	D4	D4
D3	D3	D3	D3	D3	D3

Note (*) : Q3 and Q4 are not mounted.

REV. No.	11
PCB version No.	11

Figure C-1 (2) Circuit Diagram of Printer Unit 2/6

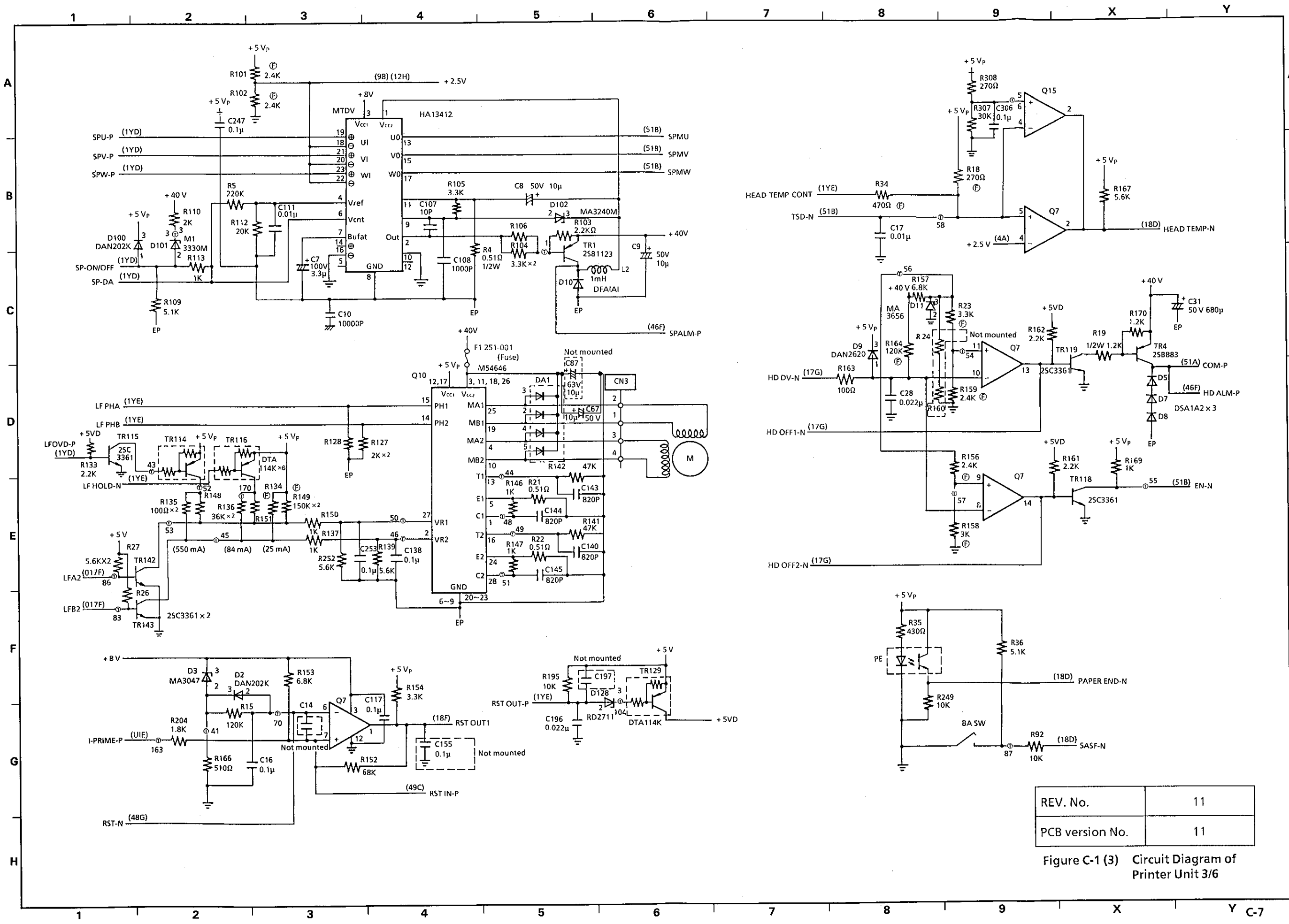
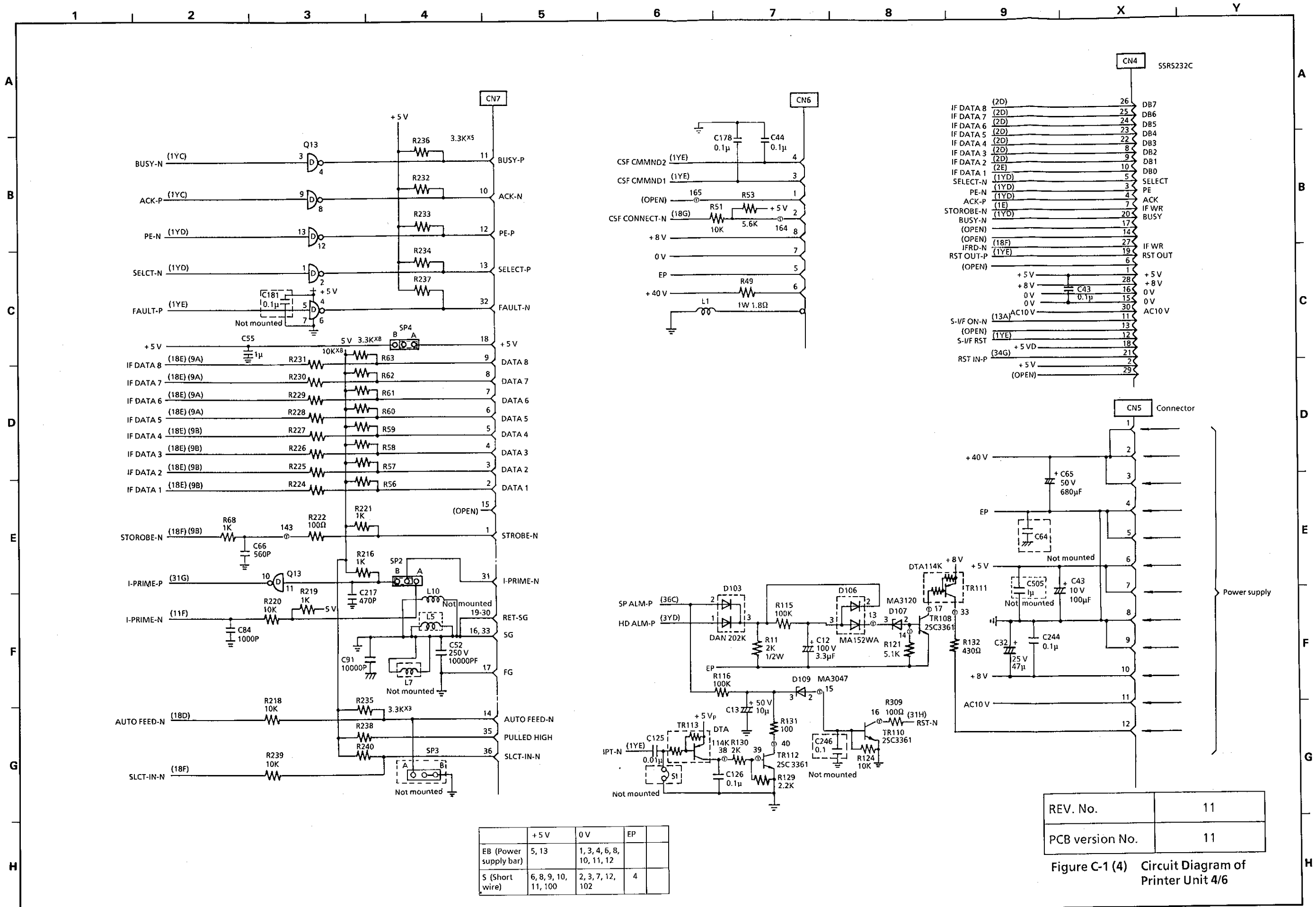


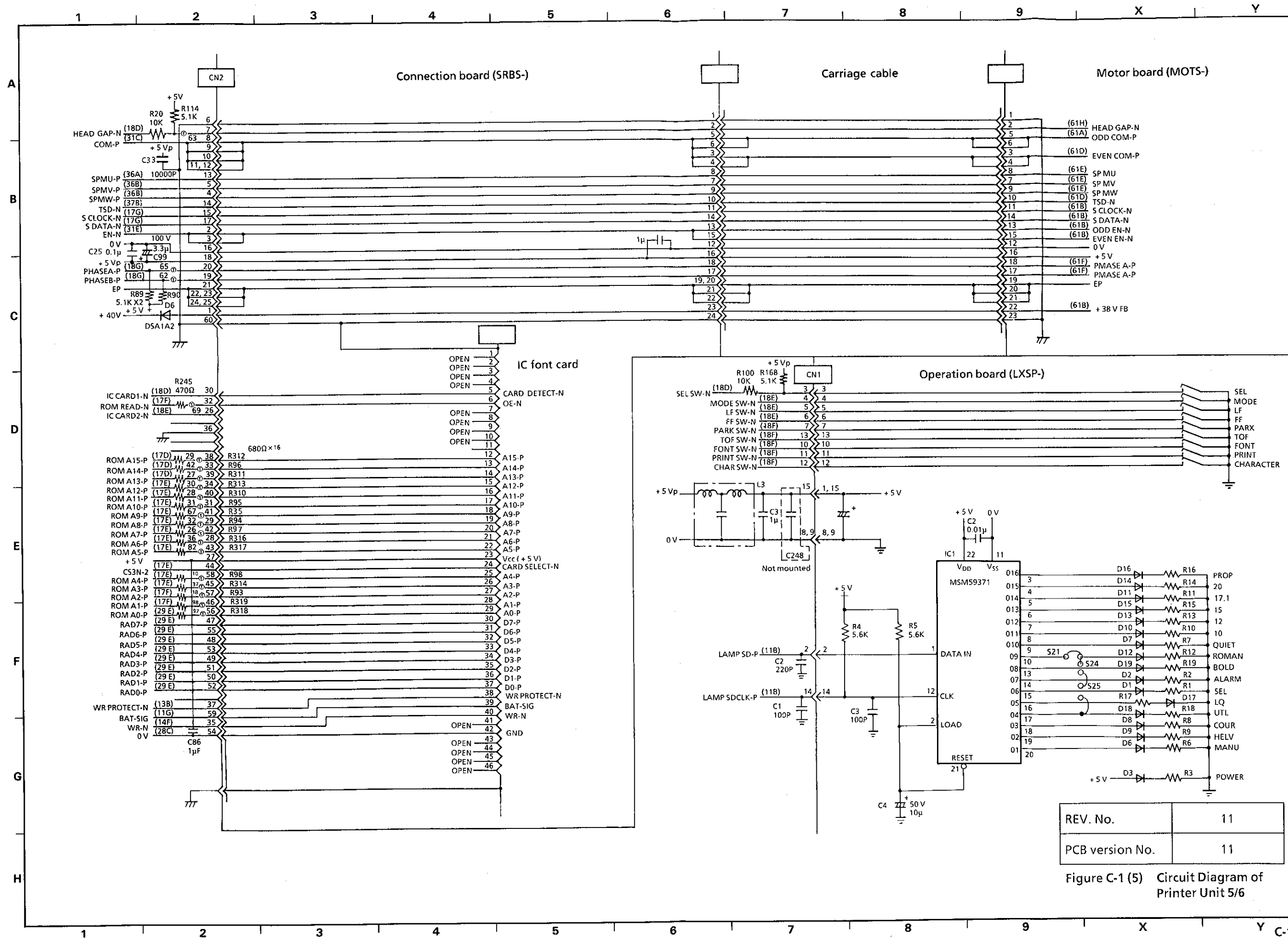
Figure C-1 (3) Circuit Diagram of Printer Unit 3/6



	+5 V	0 V	EP	
EB (Power supply bar)	5, 13	1, 3, 4, 6, 8, 10, 11, 12		
S (Short wire)	6, 8, 9, 10, 11, 100	2, 3, 7, 12, 102	4	

REV. No.	11
PCB version No.	11

Figure C-1 (4) Circuit Diagram of Printer Unit 4/6



REV. No.	11
PCB version No.	11

Figure C-1 (5) Circuit Diagram of Printer Unit 5/6

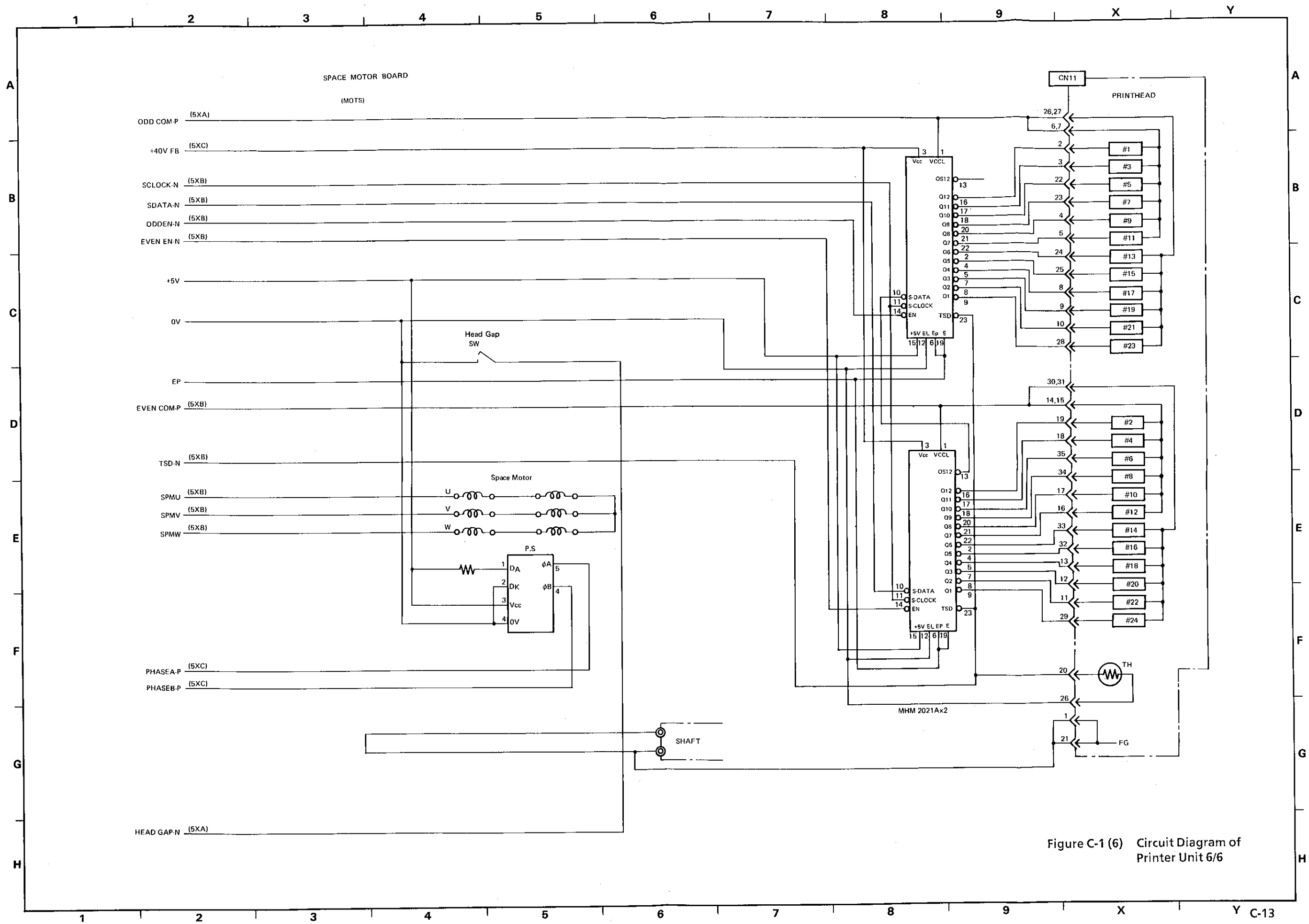
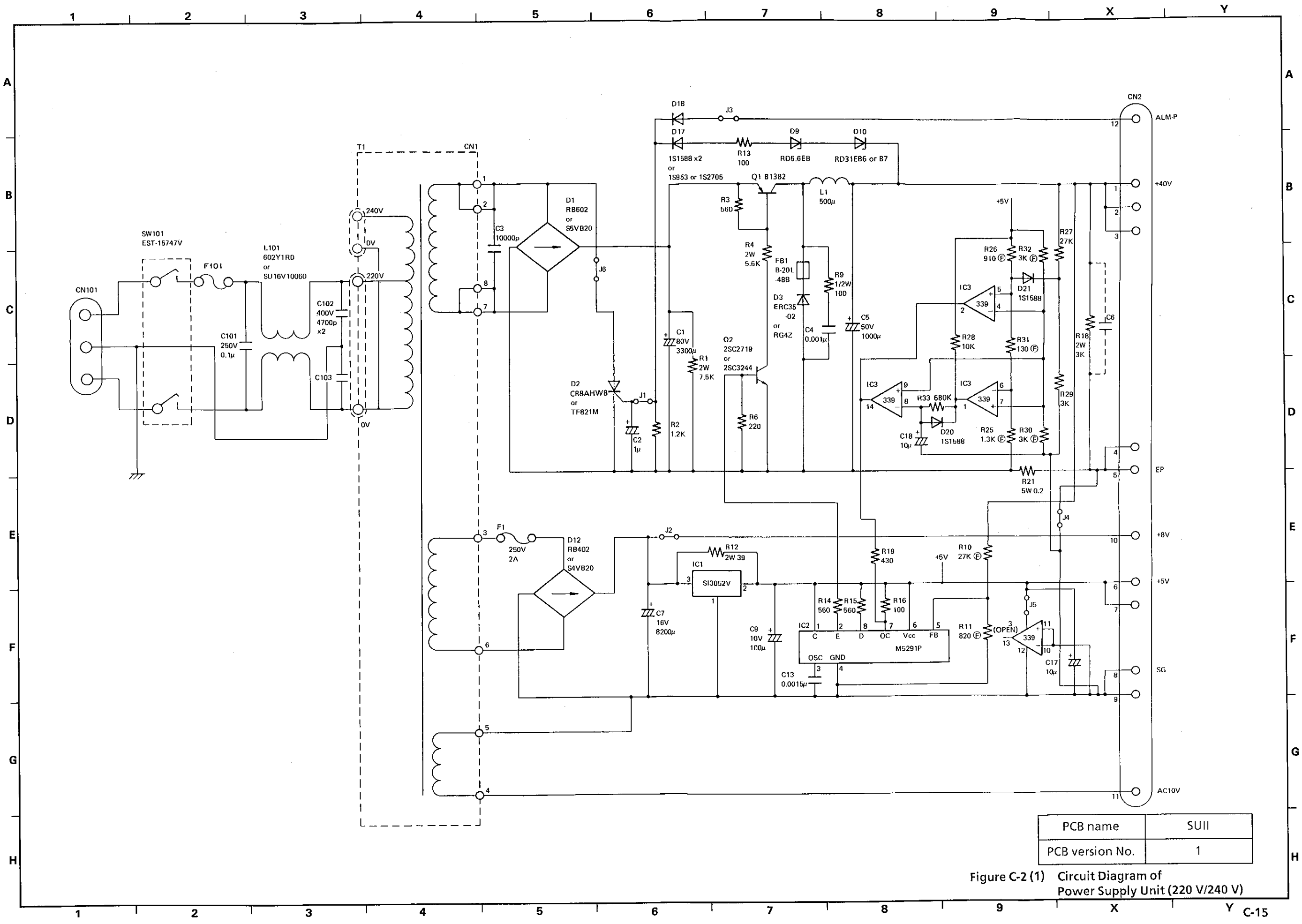


Figure C-1 (6) Circuit Diagram of Printer Unit 6/6



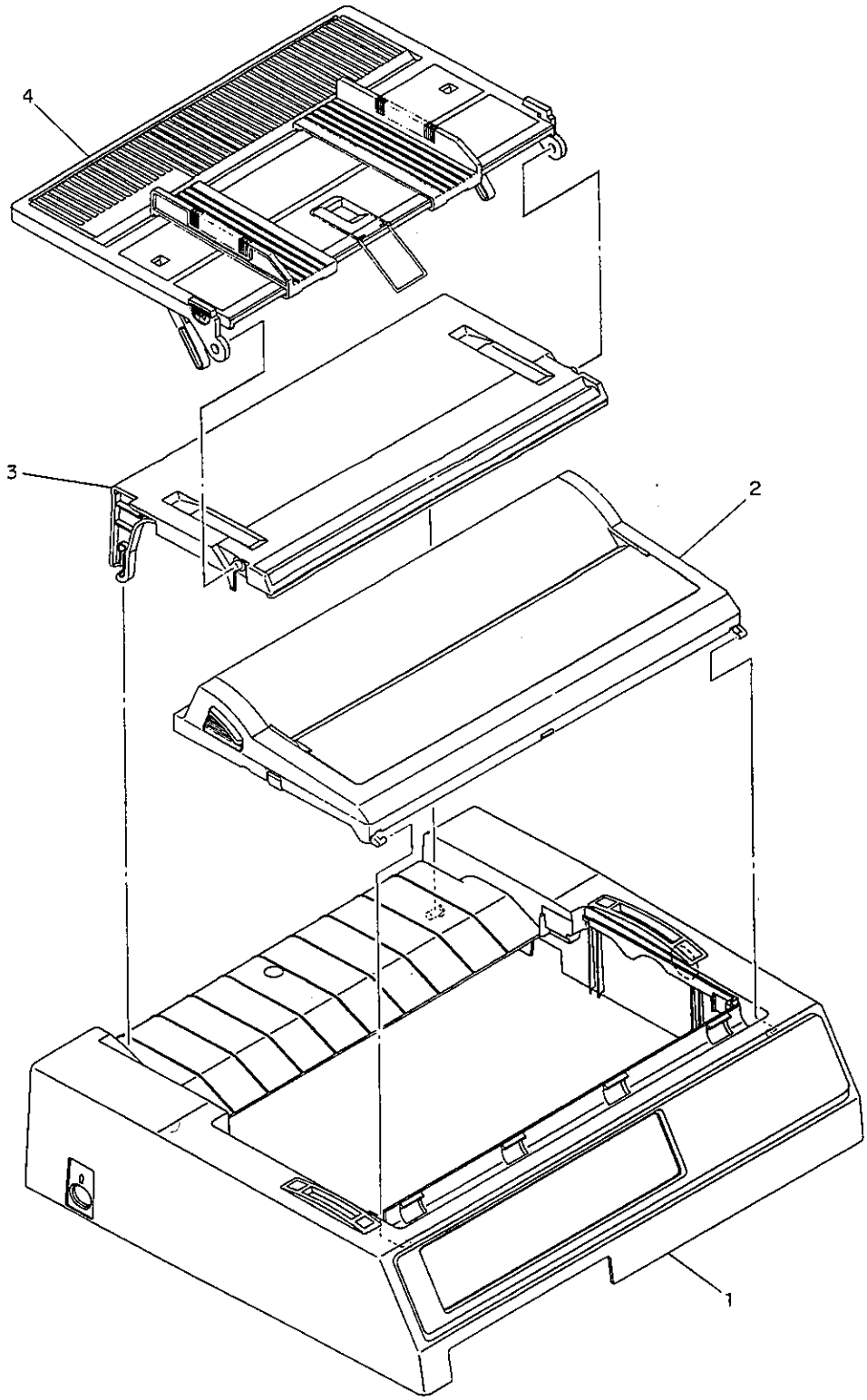
PCB name	SUII
PCB version No.	1

Figure C-2 (1) Circuit Diagram of Power Supply Unit (220 V/240 V)

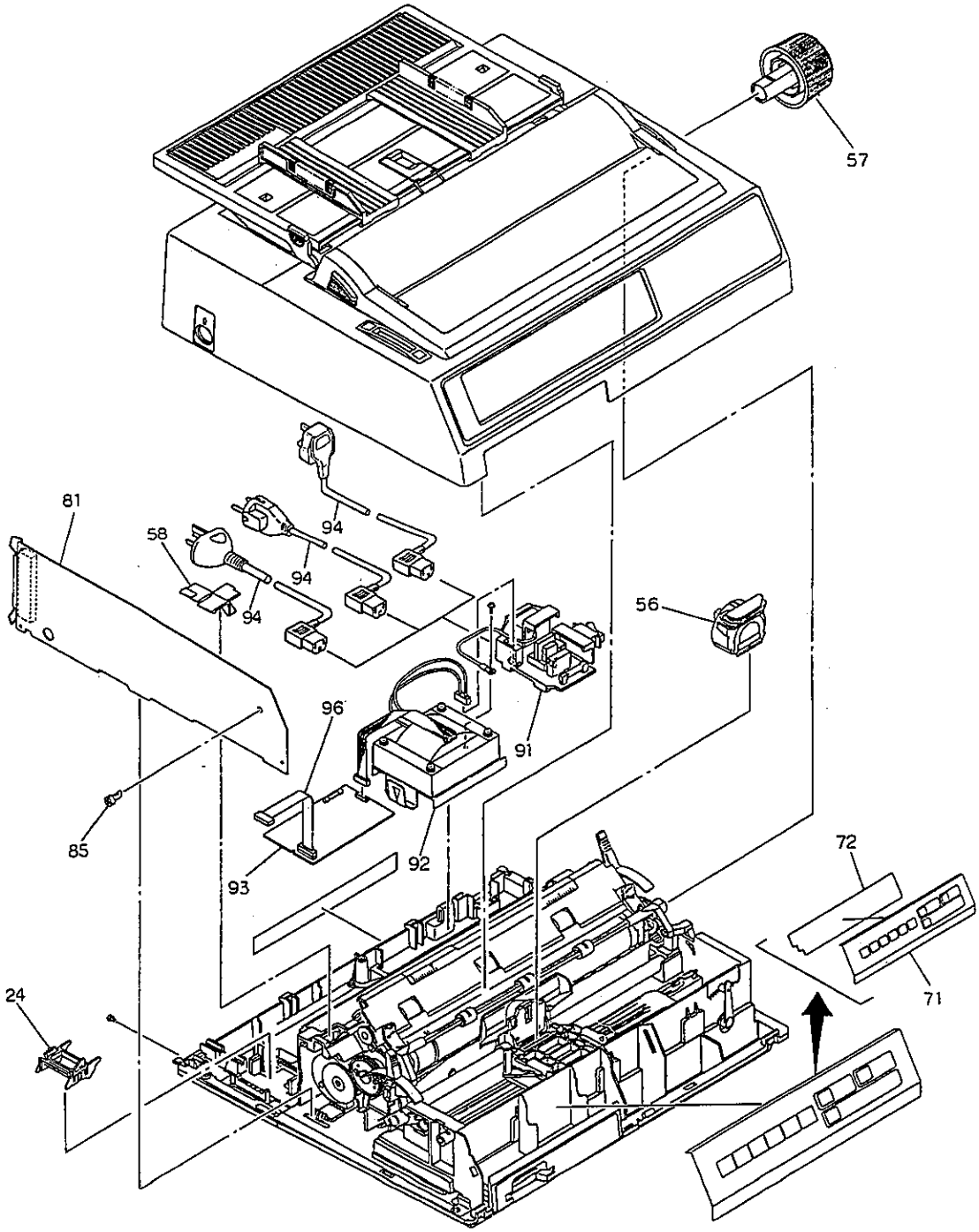
APPENDIX D SPARE PARTS LIST

Quantity of spare parts : Indicates the quantity necessary to maintain the units for one year/period.

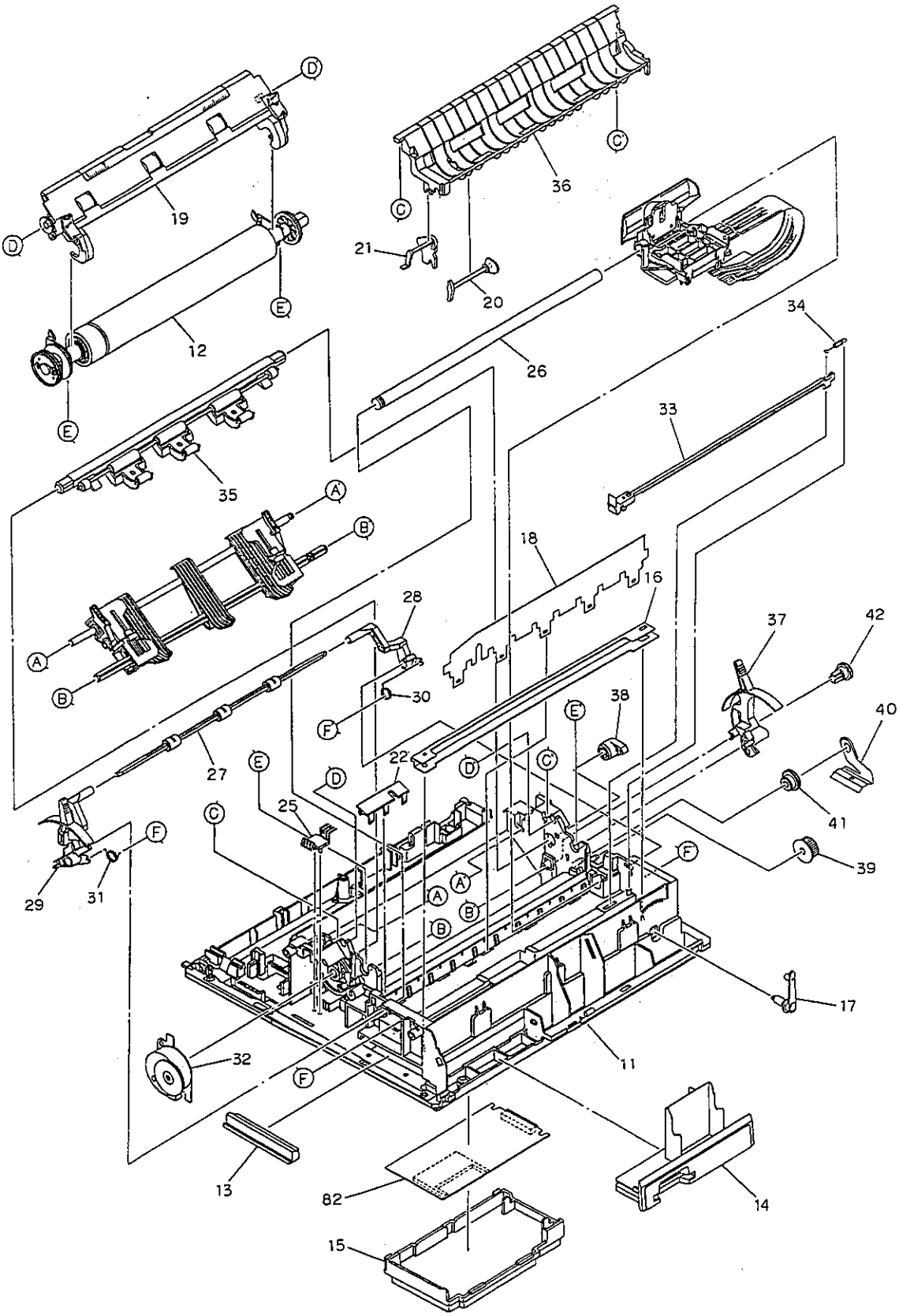
Condition : Number of units = 500 units
To be operated 2 hours/day
600 hours/year



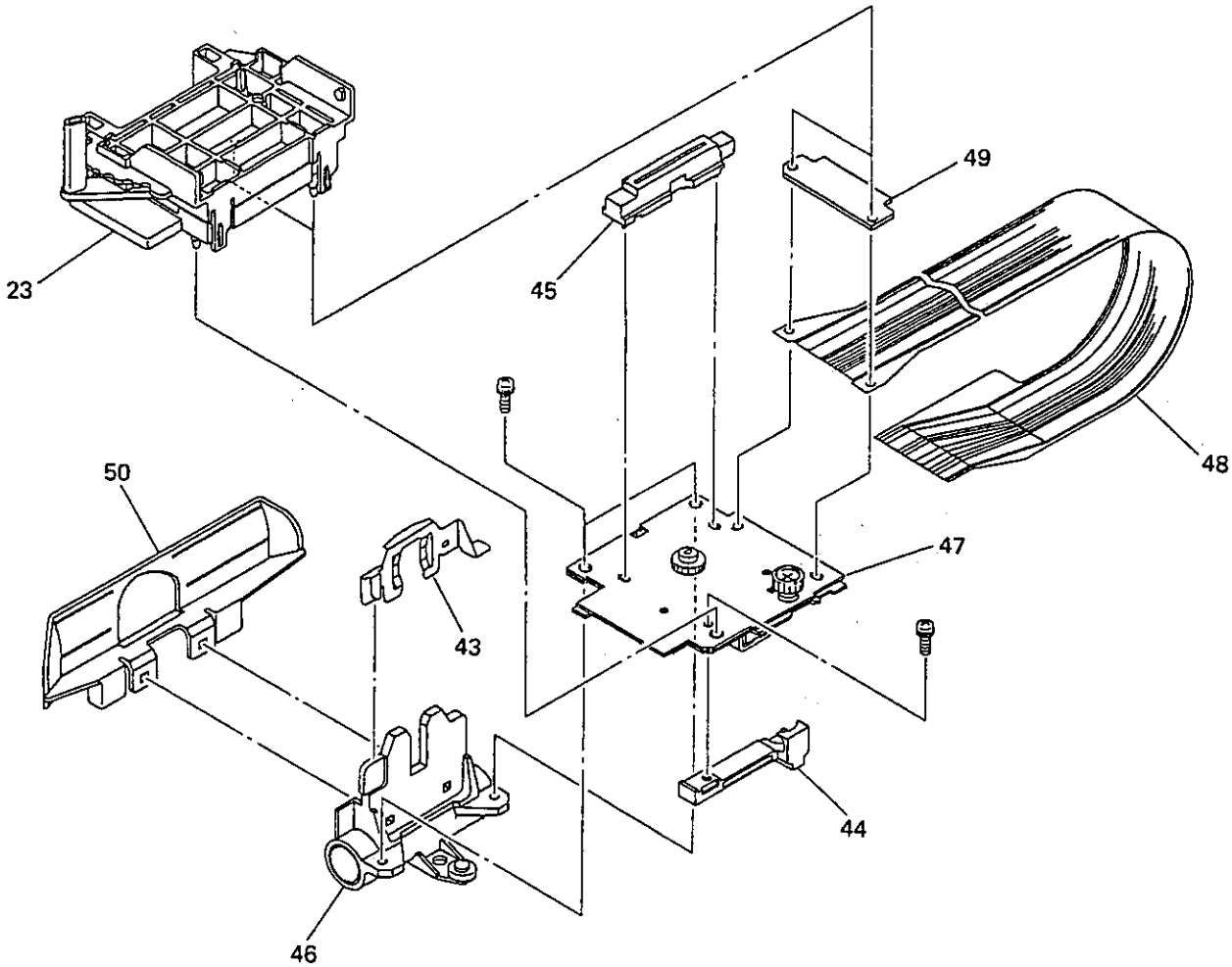
Printer unit (1/5)



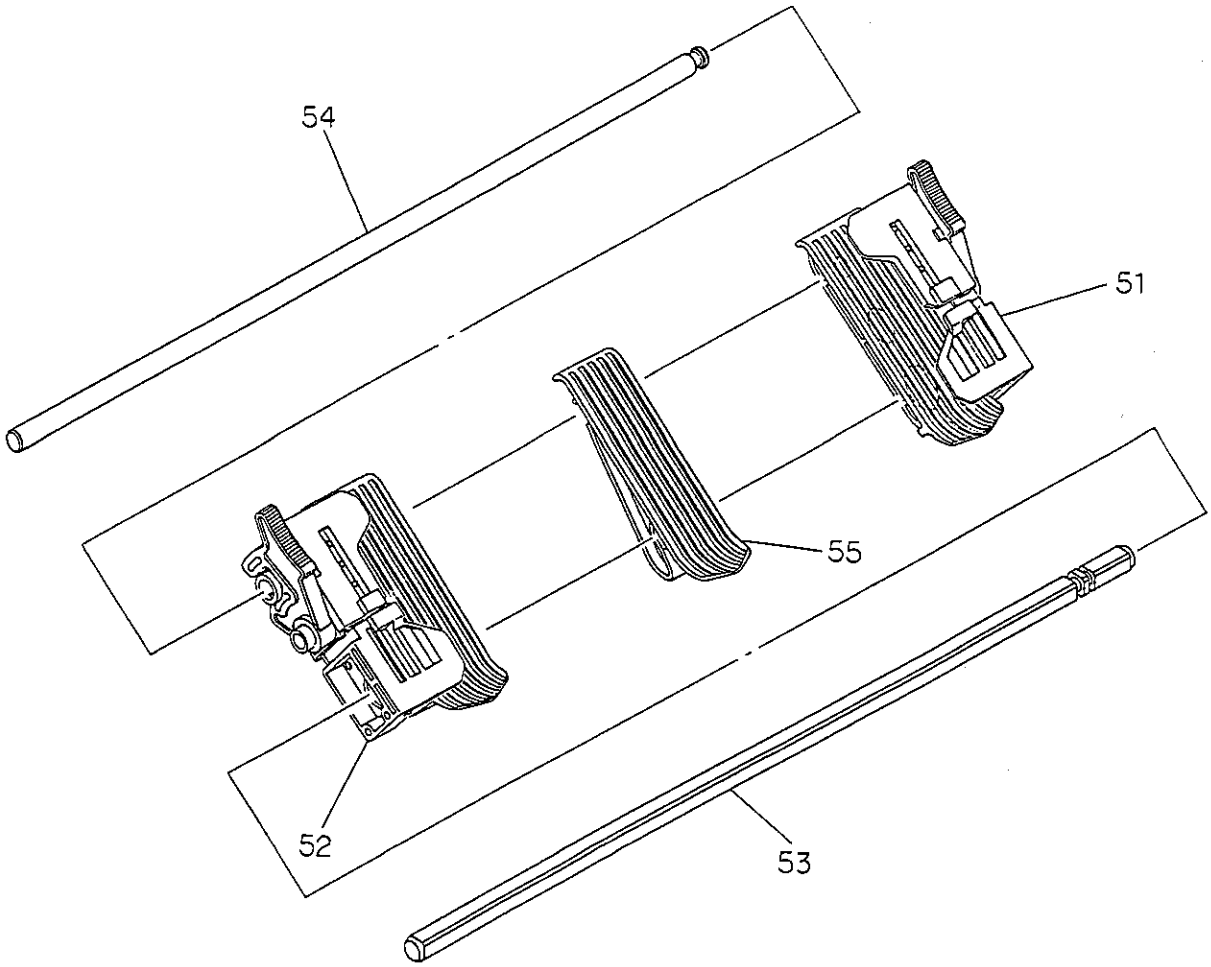
Printer unit (2/5)



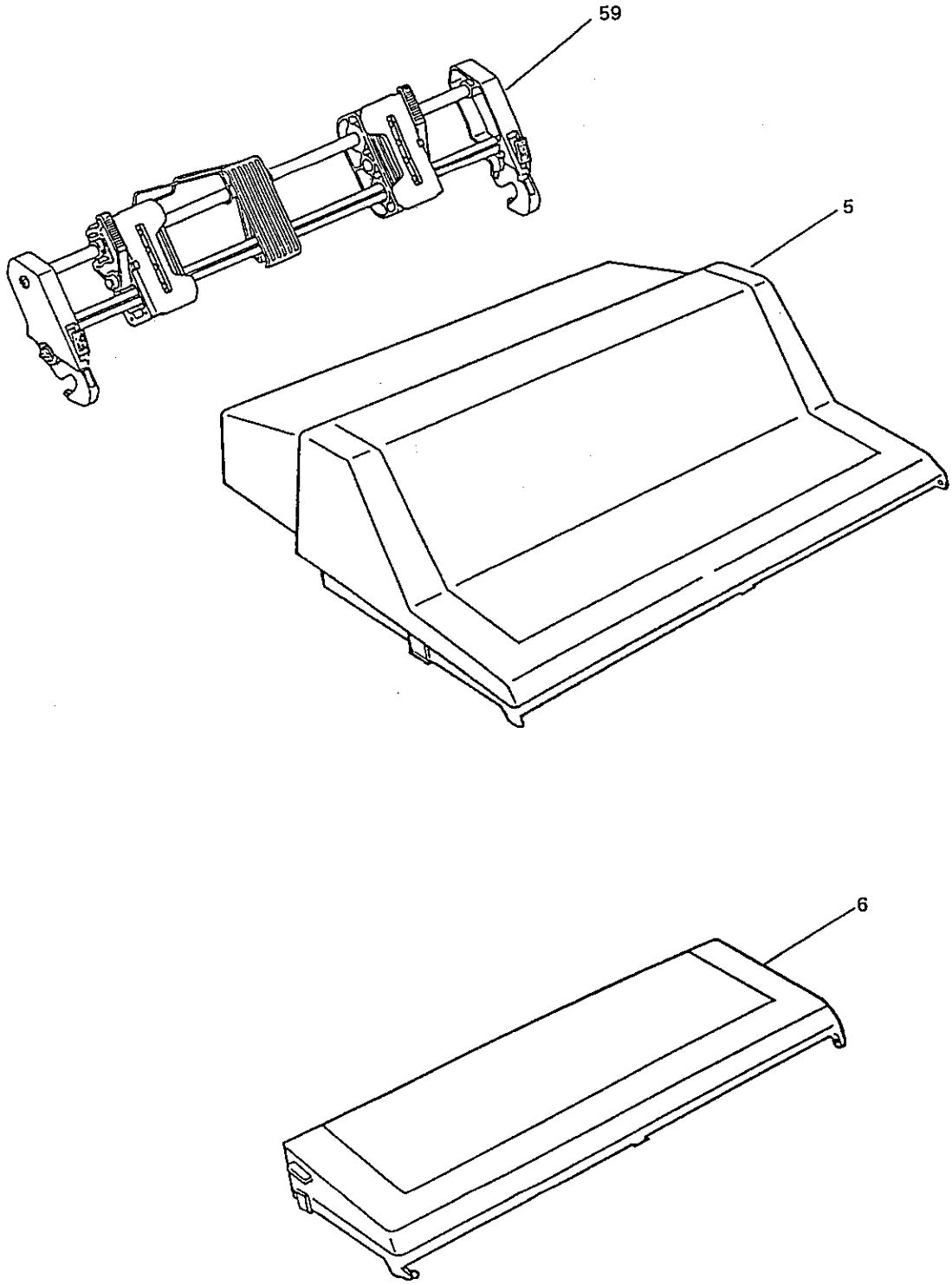
Printer unit (3/5)



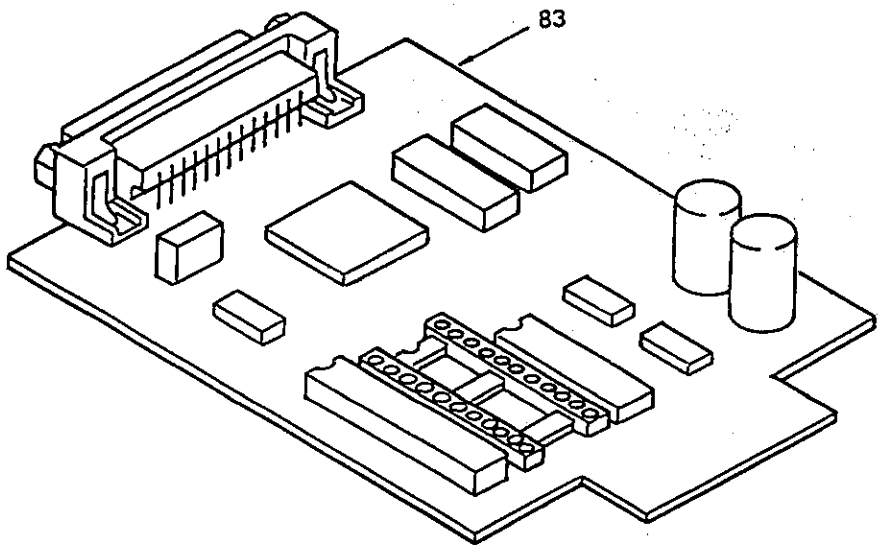
Printer unit (4/5)

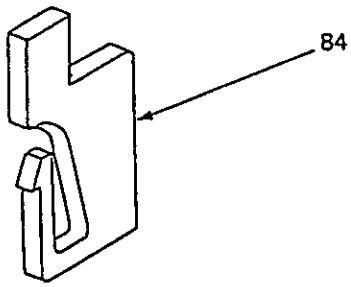


Printer unit (5/5)



Option parts (1/2)





Option parts (2/2)

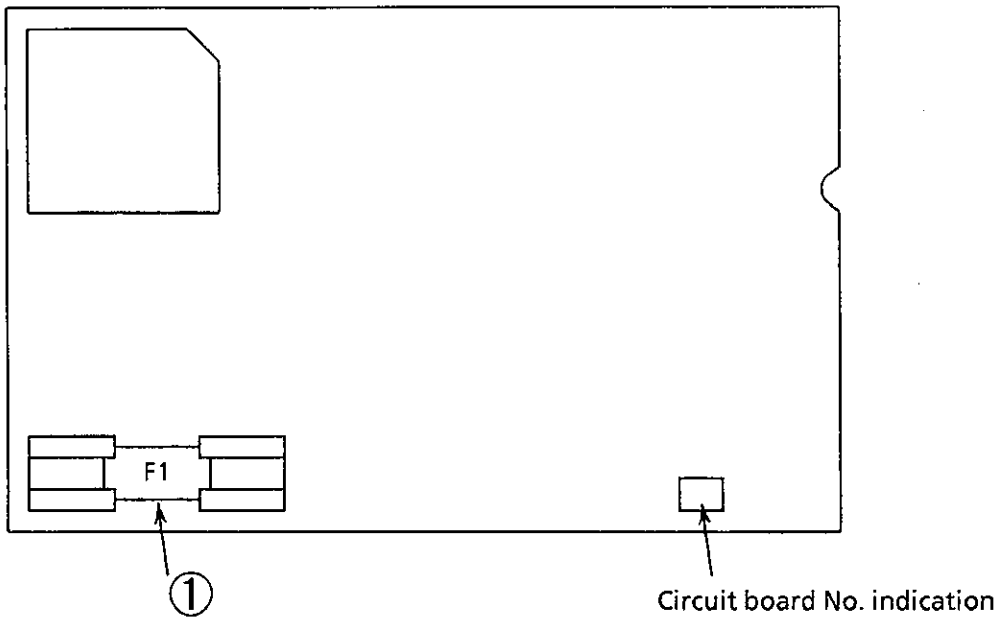
No.	Item No.	Item name	Q'ty	Q'ty of spare parts/year 500	Remarks
	(Cover parts)				
1	1PP4016-6557P27	Middle cover	1	3	390 Elite
	1PP4016-6558P27	Middle cover	1	3	391 Elite
2	2PA4016-6559G1	Access cover assembly	1	3	390 Elite
	2PA4016-6560G1	Access cover assembly	1	3	391 Elite
3	1PP4016-6567P1	Rear cover frame	1	3	390 Elite
	1PP4016-6568P1	Rear cover frame	1	3	391 Elite
4	1PA4016-6569G1	Sheet separator assembly	1	3	390 Elite
	1PA4016-6570G1	Sheet separator assembly	1	3	391 Elite
5	2PP4016-6865G1	Acoustic cover (TR)	1	3	390 Elite option
	2PP4016-6866G1	Acoustic cover (TR)	1	3	391 Elite option
6	2PP4016-6867G1	Acoustic cover (CSF)	1	3	390 Elite option
	2PP4016-6868G1	Acoustic cover (CSF)	1	3	391 Elite option
	(Printer Mechanism)				
11	3PA4025-2802G1	Main frame assembly	1	3	390
	3PA4025-2902G1	Main frame assembly	1	3	391
12	3PA4025-2811G5	Platen assembly	1	3	390
	3PA4025-2811G6	Platen assembly	1	3	391
13	224A1152P0600	AKT-60 (Connection connector)	1	3	
14	2PP4025-2805P1	IC card panel B	1	1	
15	3PA4025-2806G1	Board support cover assembly	1	3	
16	3PP4025-2809P1	Guide rail	1	1	390
	3PP4025-2809P2	Guide rail	1	1	391
17	4PP4025-2810P1	Adjusting cam	1	3	

No.	Item No.	Item name	Q'ty	Q'ty of spare parts/year	Remarks
				500	
18	3PP4025-2819P1	Paper pressure guide	1	3	390 Elite
	3PP4025-3179P1	Paper pressure guide	1	3	391 Elite
19	3PA4025-2963G1	Separator (N) assembly	1	3	390 Elite
	3PA4025-2978G1	Separator (W) assembly	1	3	391 Elite
20	3PP4025-2825P1	Paper end lever (B)	1	3	390 Elite
	3PP4025-2825P2	Paper end lever (B)	1	3	391 Elite
21	3PP4025-2826P1	Sensor lever	1	3	
22	3PP4025-2827P1	Sensor cover	1	3	
23	4PA4025-2832G1	Ribbon drive gear assembly	1	3	
24	4PB4025-3180P1	Cord guide	1	3	
25	3PP4025-2874P1	LF motor interconnect module	1	3	
26	4PP4025-2837P1	Carriage shaft	1	3	390 Elite
	4PP4025-2837P2	Carriage shaft	1	3	391 Elite
27	4PA4025-2838G1	Indicator assembly	1	3	390 Elite
	4PA4025-2838G2	Indicator assembly	1	3	391 Elite
28	3PP4025-2840P1	Bail arm (R)	1	3	
29	2PP4025-2841P1	Bail arm (L)	1	3	
30	4PB4025-2842P1	Bail arm spring (R)	1	5	
31	4PB4025-2843P1	Bail arm spring (L)	1	5	
32	3PB4025-2844P3	LF motor	1	5	
33	3PP4025-2845P1	Space rack	1	5	390 Elite
	3PP4025-2845P2	Space rack	1	5	391 Elite
34	4PB4025-2873P1	Tension spring	1	3	
35	3PA4025-2846G1	Pressure roller assembly (N)	1	3	390 Elite
36	3PA4025-2908G1	Pressure roller assembly (W)	1	3	391 Elite

No.	Item No.	Item name	Q'ty	Q'ty of spare parts/year	Remarks
				500	
36	3PA4025-2853G1	Paper chute assembly (N)	1	3	390 Elite
	3PA4025-2915G1	Paper chute assembly (W)	1	3	391 Elite
37	3PP4025-2852P1	Release lever	1	3	
38	4PP4025-2881P1	Release link	1	3	
39	4PP4025-2866P1	Change gear	1	3	
40	4PP4025-2867P1	Reset spring	1	3	
41	4PP4025-2868P1	Idler gear	1	3	
42	4PP4025-2869P1	Tractor gear	1	3	
43	4PP4025-1048P1	head clamp	1	3	
44	4PB4025-1088P1	Slider	1	3	
45	3PB4025-1241P1	Connector	1	3	
46	4PB4025-2829G2	Carriage frame set	1	3	
47	4YX4025-2052G4	Space motor assembly	1	5	
48	2PU4007-1095P3	Flexible cable	1	10	390 Elite
	2PU4007-1095P4	Flexible cable	1	10	391 Elite
49	4PP4025-2960P1	Contact pressure rubber	1	3	
50	3PP4025-2836P1	Ribbon protector	1	5	
51	4PA4025-2855G1	Tractor frame assembly (R)	1	3	
52	4PA4025-2861G1	Tractor frame assembly (L)	1	3	
53	4PP4025-2864P1	Drive shaft	1	1	390 Elite
	4PP4025-2864P2	Drive shaft	1	1	391 Elite
54	4PP4025-2831P1	Lock shaft	1	1	390 Elite
	4PP4025-2831P2	Lock shaft	1	1	391 Elite
55	3PP4025-2927P1	Sheet guide	1	3	

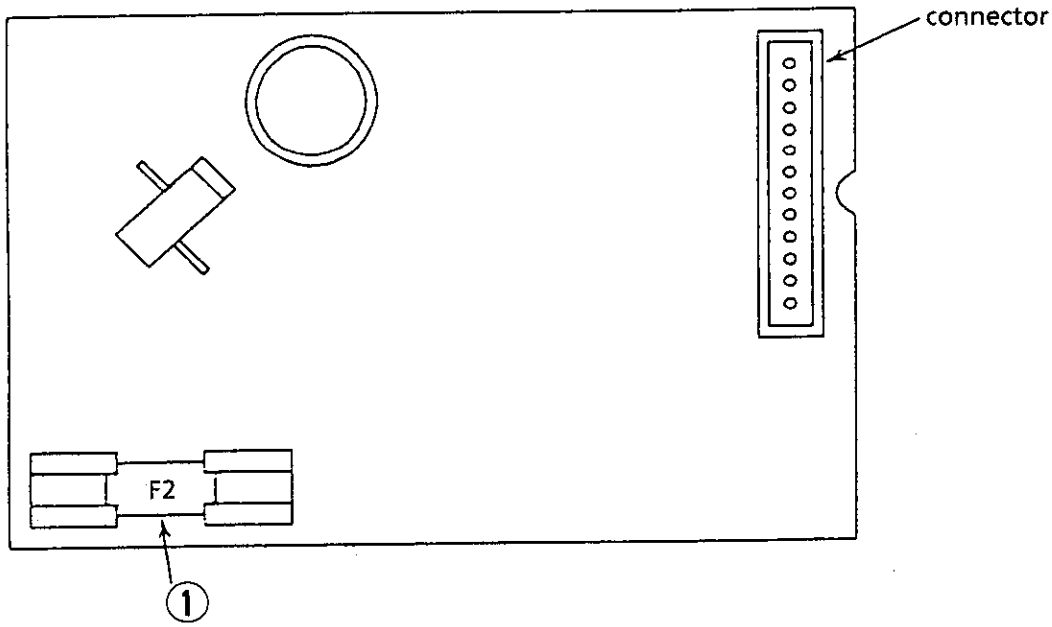
No.	Item No.	Item name	Q'ty	Q'ty of spare parts/year 500	Remarks
56	4YA4023-2011G1	Head	1	9	
57	3PP4025-2871P1	Platen knob	1	3	
58	3PP4025-2896P1	Board lock	1	3	
59	3PA4025-2971G1	Tractor unit (N)	1	3	390 Elite option
	3PA4025-2971G2	Tractor unit (W)	1	3	391 Elite option
	(Operator panel)				
71	3PP4025-3114G12	Operator panel	1	3	
72	4YA4021-1048G5	LXSP-5 printed circuit board	1	3	
	(Printed circuit board)				
81	4YA4021-1052G202	SKRA-printed circuit board	1	3	390/391 Elite For maintenance (without ROMS)
82	4YA4021-1049G1	SRBS printed circuit board	1	3	
83	4YA4021-1050G003	LXHI printed circuit board	1	3	Option (ODG)
84	4PP4025-2887P1	Interface Lock	1	3	
85	4PP4025-2870P1	Lock post	1	3	
	(Power supply assembly)				
91	4YX4056-3477G2	Filter assembly	1	3	220/240V
92	4YB4056-8348P1	Transformer	1	3	390 220/240V
	4YB4056-8348P2	Transformer	1	3	391 220/240V
93	3YU5057-3311G1	SUII printed circuit board	1	3	

No.	Item No.	Item name	Q'ty	Q'ty of spare parts/year 500	Remarks
94	3YS4011-1052P1	AC cable	1	1	220V, Continental
	3YS4011-1192P1	AC cable	1	1	240V,British
	3YS4011-1103P1	AC cable	1	1	240V,Oceanian
96	4YS4011-4311P2	Connector cord	1	3	
91'	4YB4049-1457P2	Filter assembly	1	3	220/240V, only Europe (OKI-UK)
92'	4YB4049-1460P1	Transformer	1	3	390 Elite 220/240V, only Europe (OKI-UK)
	4YB4049-1460P2	Transformer	1	3	391 Elite 220/240V, only Europe (OKI-UK)
93'	4YB4049-1458P5	DC PSU board	1	3	Only Europe (OKI-UK)
94'	3YS4011-1172P1	AC cable	1	1	220V, Continental
	3YS4011-1173P1	AC cable	1	1	240V,British



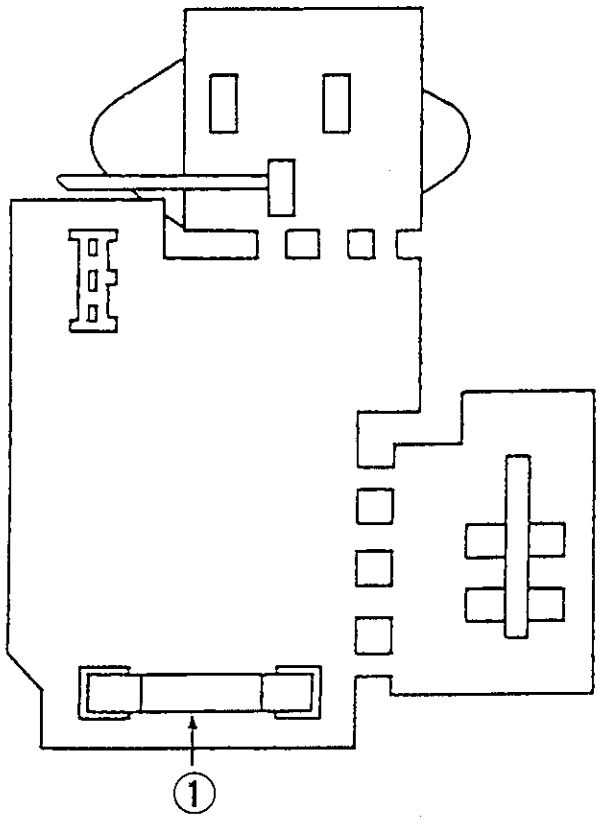
Item No.	Part NO.	Description	Qty	Remarks
1	4FP-21107-2	Fuse 2A	1	

SUII printed-circuit board (1/1)



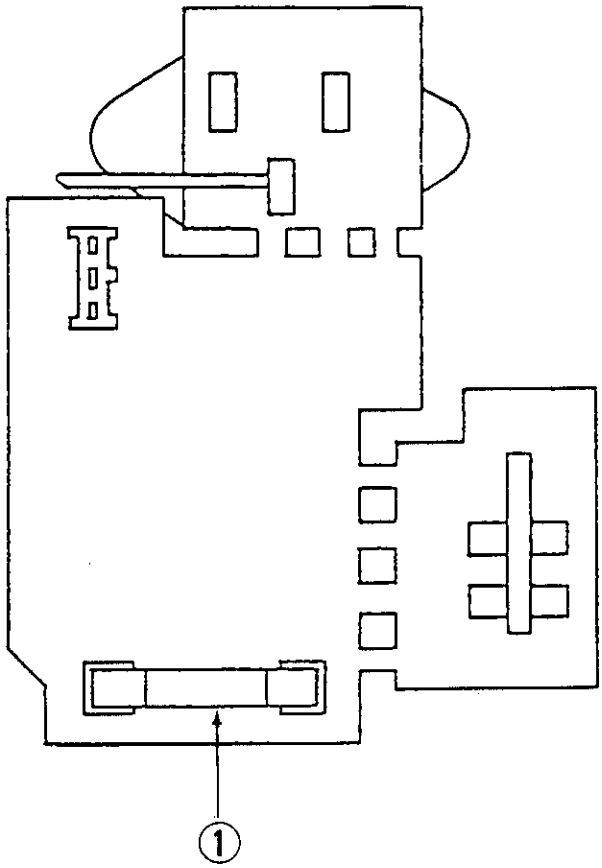
Item No.	Part NO.	Description	Qty	Remarks
1	4YB4049-1566P1	Fuse 2A	1	

DC PSU board for only Europe (OKI-UK) (1/1)



Item No.	Part NO.	Description	Qty	Remarks
1	4FP-21108-2	Fuse 2A	1	220/240V

Filter board (1/1)



Item No.	Part NO.	Description	Qty	Remarks
1	4YB4049-1565P1	Fuse 2A	1	220/240 V

Filter board for only Europe (OKI-UK) (1/1)

APPENMDIX E RS-232C (for ML390/391/320/321 Elite) SERIAL INTERFACE BOARD

1. GENERAL

This section describes the operation of the RS-232C Serial Interface board installed in the Microline 390/391/320/321 Elite as an option using a start-stop synchronization and serial communications circuit. This serial interface board is capable of transmitting and receiving simultaneously at speeds up to 19,200 bits per second. Two protocols are available: printer Ready/Busy and X-ON/X-OFF modes.

2. OPERATION DESCRIPTION

2.1 Element Description

(1) 80C51 with MASK ROM

An eight-bit microprocessor controller that controls the following:

(a.) Serial interface protocol and data transfer through a serial port.

(b.) Message buffer.

(c.) Transmission of parallel data to the printer.

(2) SN75189

An RS-232C standard line receiver

(3) SN75188

An RS-232C standard line driver.

(4) 2764

An 8 kbyte ROM that contains the serial interface control program.

(5) HM6264

An 8192-byte static RAM used as a message buffer.

2.2 Circuit Description

A block diagram is shown in Figure E-2-1.

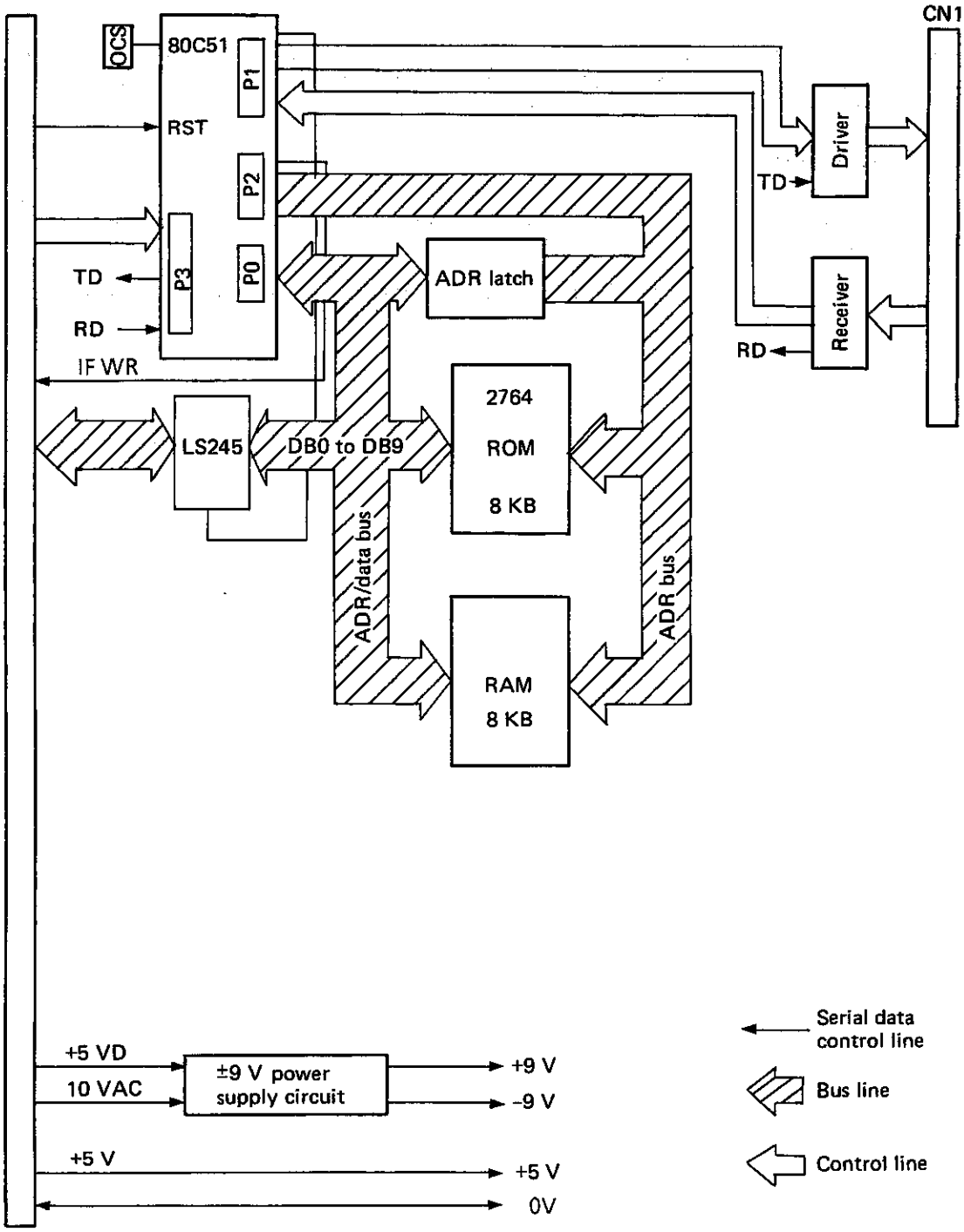


Figure E-2-1 Block diagram

2.2.1 Operation at power on

After power is turned on, an RST OUT signal is sent from the printer control board to reset the printer. When the reset is canceled, the 80C51 CPU performs initialization. Initialization consists of setting the 80C51 timer, and setting the serial mode.

2.2.2 RS-232C interface

The DTR, SSD, TD and RTS signals output by the 80C51 are converted to RS-232C signals by line driver SN75188 (Q1) and sent to the interface.

In addition, signals DSR, CTS, CD, and RD on the RS232C interface are converted to TTL level by line receiver SN75189 (Q2) and input to the 80C51.

2.3 Communication Procedure Flowchart

2.3.1 Mode ⓐ

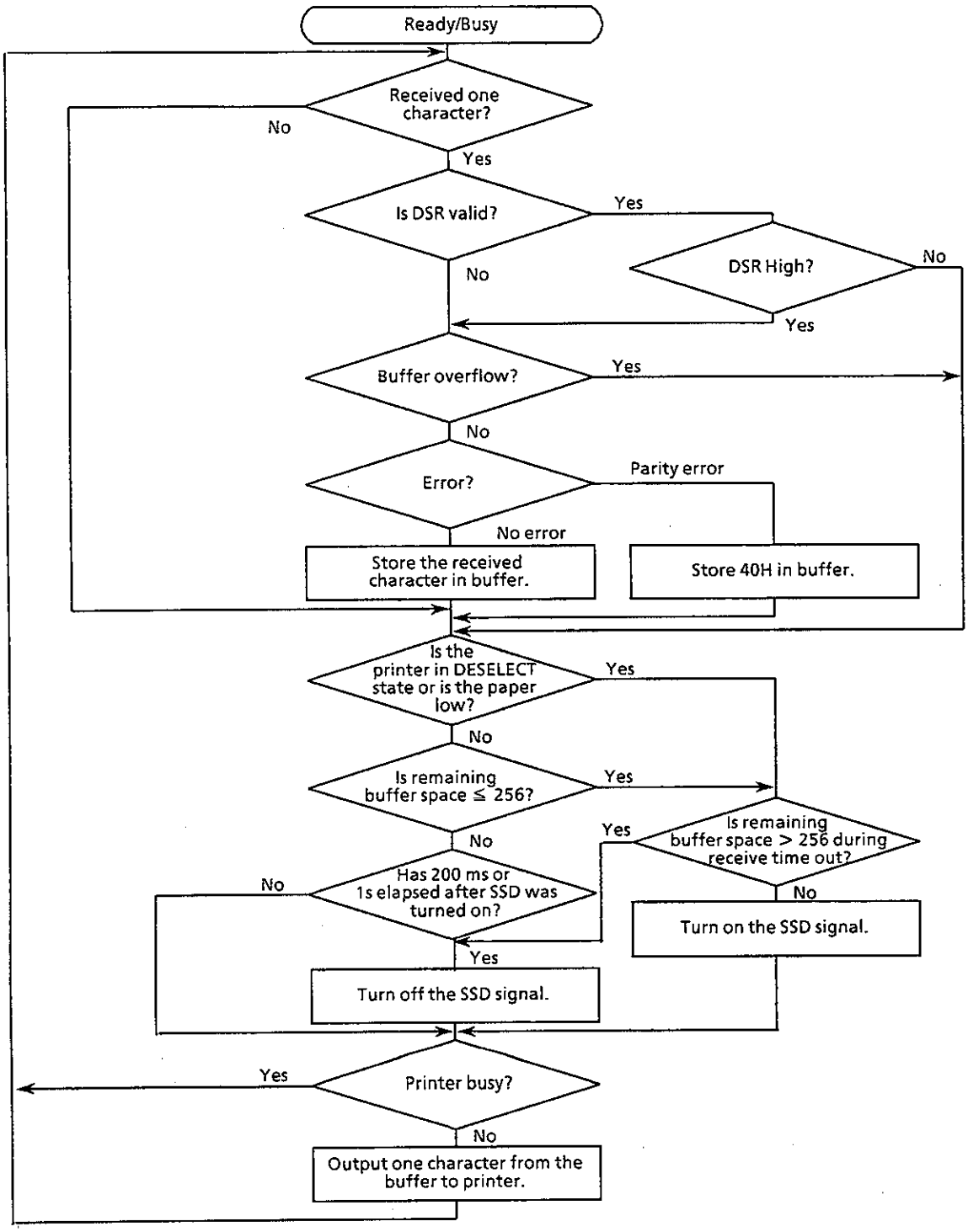


Figure E-2-2

2.3.2 Mode ⓑ

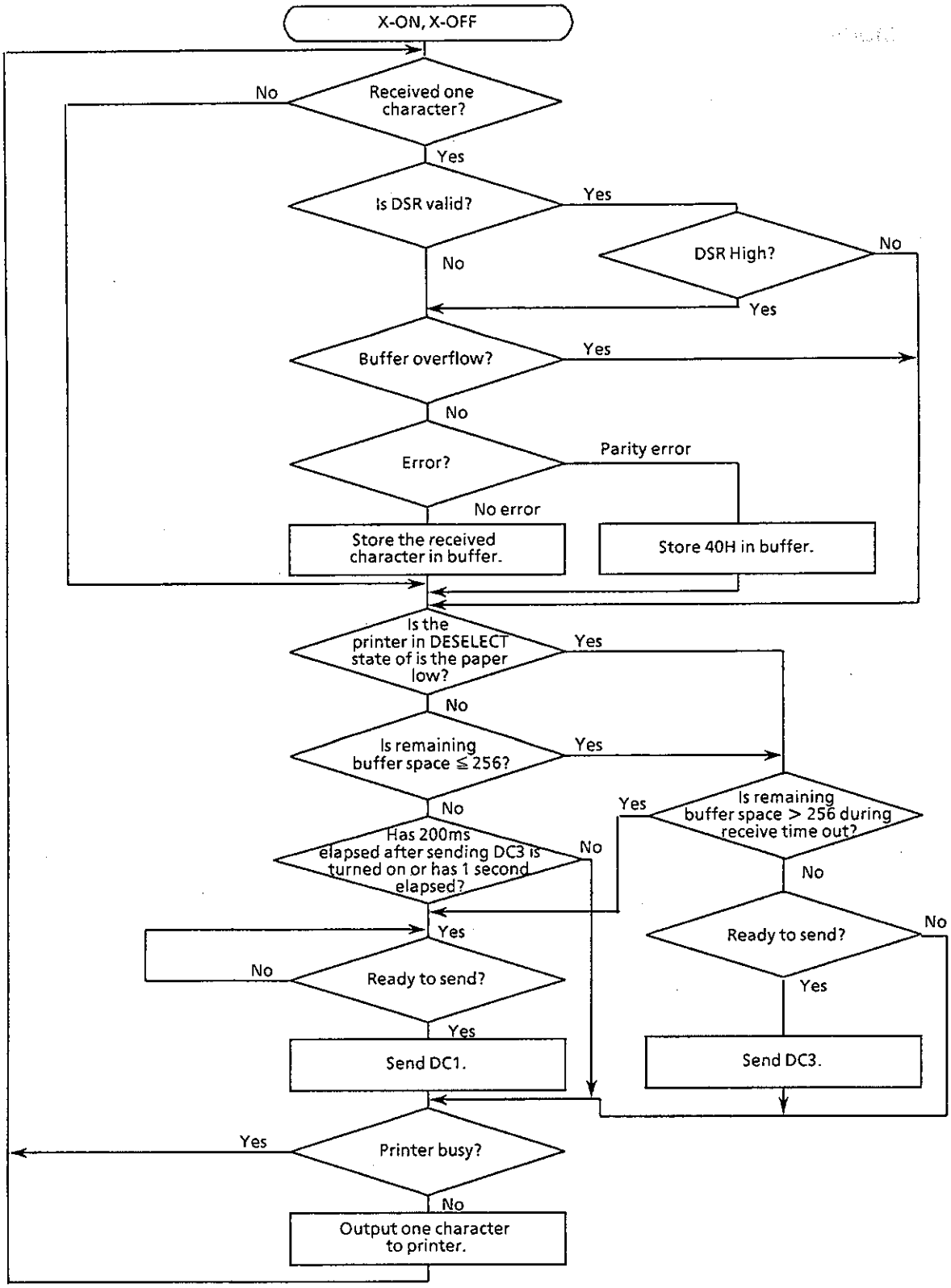


Figure E-2-3

3. TROUBLESHOOTING FLOWCHART

3.1 Before Repairing a Fault

Before servicing the printer, ask the customer in what situation the trouble occurred and record the response.

Before starting troubleshooting, operate the printer in the same situation as that at the time of trouble occurrence to see if the same trouble occurs again. If not, perform the printers self test and thoroughly test the printers functionality. If the trouble is reproducible proceed to the trouble-shooting section.

3.2 Troubleshooting

(1) The data is not received using a serial interface.

(2) Using a serial interface, the print data is omitted or the print operation is not performed.

① The data is not received using a serial interface.
(A protocol is set to READY/BUSY state, and BUSY LINE is in SSD + state.)

- Is the OSC oscillation waveform as specified in Figure E-3-1?

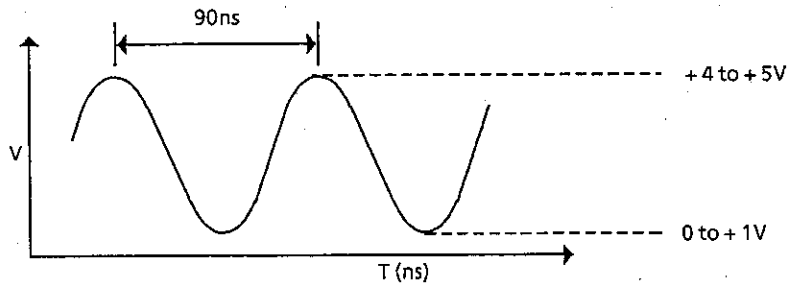


Figure E-3-1

- No Replace the OSC.

- Yes Is a RST signal in Q3 is as specified in Figure E-3-2?

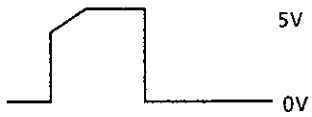


Figure E-3-2

- No Check the RST circuit on the SKRA board.

Ⓐ

Ⓐ

Yes Are ALE, $\overline{PSEN}$, $\overline{RD}$, $\overline{WR}$, signals as specified in Figure E-3-3?

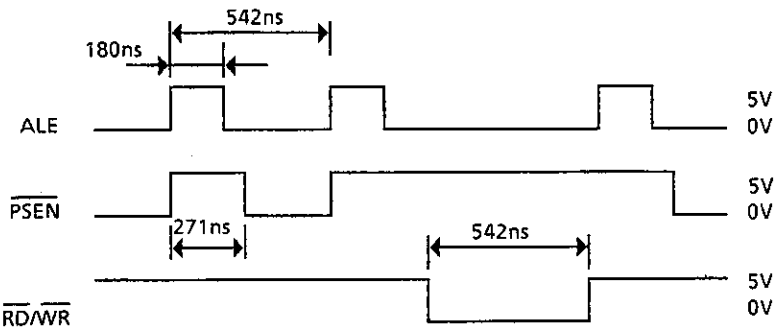


Figure E-3-3

- No Replace the Q3.

Yes Are (T1) $\overline{SELECT}$ and (INTO) $\overline{BUSY}$ signals low level?

- No Check Q11 on the SKRA board.

Yes Are + 9V and -9V input to Q1?

- No Replace defective component in + 9/ – 9 volt control circuit.

Yes Is pin 1 SSD signal of Q3 High level?

- No Replace the Q3.

Yes Is pin 11 SSD of Q1 low level?

- No Replace the Q1 or the CN1?

Yes Is the RxD of Q3 as specified in Figure E-3-4?

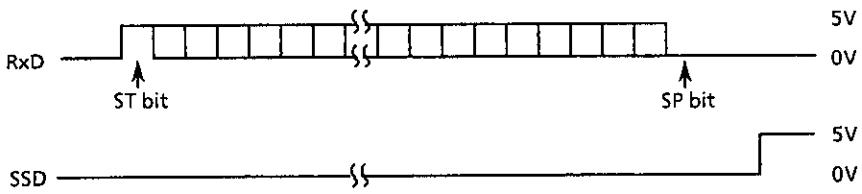


Figure E-3-4

- No Replace the Q2.

Yes Replace the Q3.

② In receiving by serial interface, printing data is omitted or printing operation is not performed.

- Are RxD and SSD of Q3 as specified in Figure E-3-4?
  - No Replace the Q2.

Yes Are, $\overline{WR}$, and BUS signals of Q3 pin 3 as specified in Figure E-3-5?

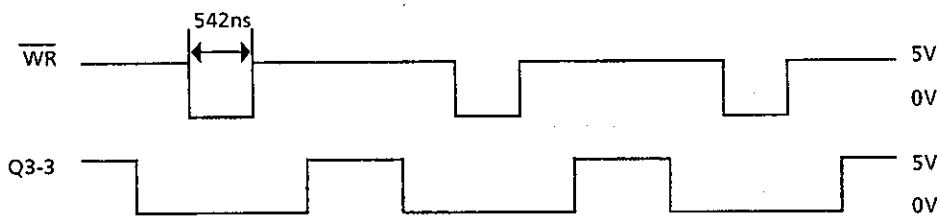


Figure E-3-5

- No Replace the Q3.

Yes Is the level of a BUS signals at Q7 pins 2-9 the same as that of DB0-7 when $\overline{WR}$ signal is started?

- No Replace the Q7.

Yes Is 4 pin of Q6 identical to $\overline{WR}$ signal in Figure E-3-5?

- No Replace the Q6.

Yes Check Q11 (LSI: MSM6990) in the SKRA control PCB.

3.3 Local Test

3.3.1 Circuit test mode

3.3.1.1 Setting

(1) Diagnostic test (set by menu)

(2) Test connector

Connect the test connector shown in Figure E-3-6 to the interface connector.

Equivalent to Cannon DB-25P

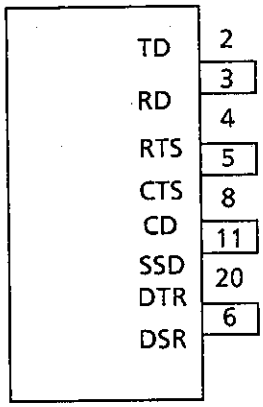


Figure E-3-6 Test connector connection diagram

3.3.1.2 Function

After the settings outlined in Section 3.3.1.1 are completed and power is turned on, the serial interface checks the message buffer memory and interface driver/receiver circuit. It then prints characters.

To start and stop this test, push the SEL switch on the front of the printer.

Details of this test are explained on the next page.

(1) The program revision using two numerical characters is printed.

(2) "LOOP TEST" is printed.

(3) Memory is checked for the message buffer.

(4) Prints "OK" is printed if the memory check is OK and "BAD" is printed if the memory check fails.

(5) Output level to DTR, RTS, and SSD signals is dropped low. If DSR, CTS, or CD signals is High, "IF BAD" is printed. If DSR, CTS, and CD signals are all Low, "IF OK" is printed.

(6) Output level to DTR, RTS, and SSD signals is raised high. If DSR, CTS, or CD signals is Low, "IF BAD" is printed. If DSR, CTS, and CD signals are all High, "IF OK" is printed.

(7) Transmits characters codes from 20H to 7FH is transmitted by SD signal. At the same time, characters are received by the RD signal and stored in the message buffer.

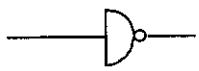
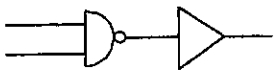
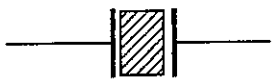
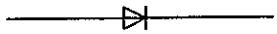
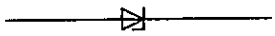
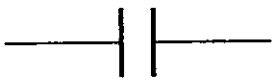
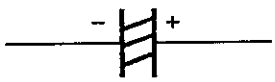
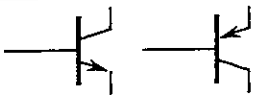
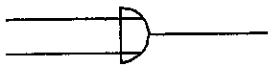
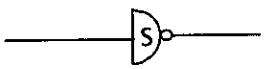
(8) The characters that were stored in the message buffer as indicated in (7) are printed.

(9) Steps (1) through (8) are repeated until test is interrupted.

4. CIRCUIT SYMBOLS AND CIRCUIT DIAGRAMS

Table E-4-1. lists the circuit symbols used in the super-speed RS-232C interface circuit diagram, and Figure E-4-1 shows the circuit diagram.

Table E-4-1

Symbol	Mark	Details
	Q	SN75189 line receiver
	Q	HD75188 line driver
	OSC	Oscillator
	D	Diode
	D	Zener diode
	C	Capacitor
	C	Electrolytic capacitor
	R	Resistor
	Tr	Transistor
	Q	MB74LS32 20R
	S	Jumper wire
	Q	74LS05

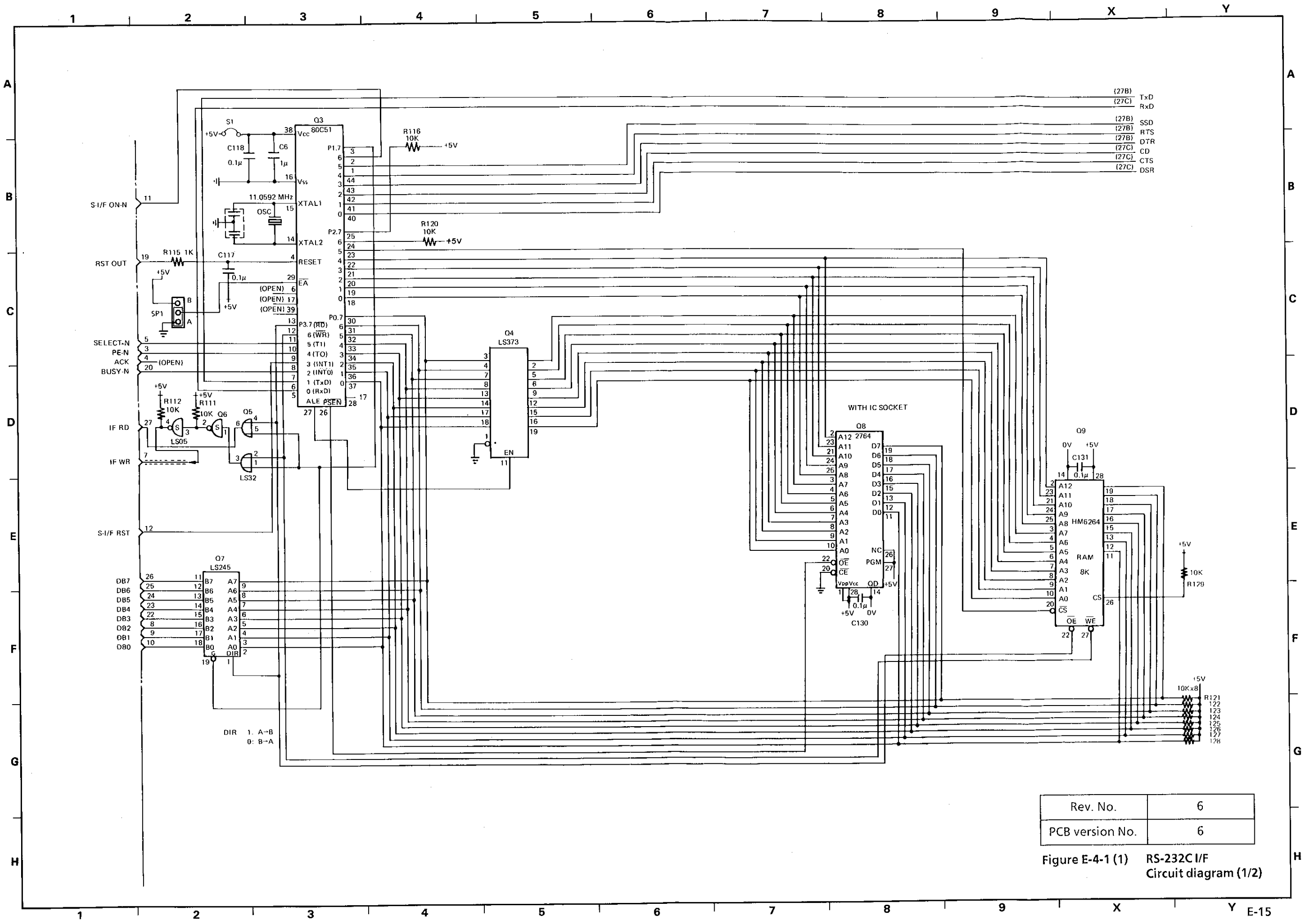


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Figure E-4-1 (1) RS-232C I/F Circuit diagram (1/2)

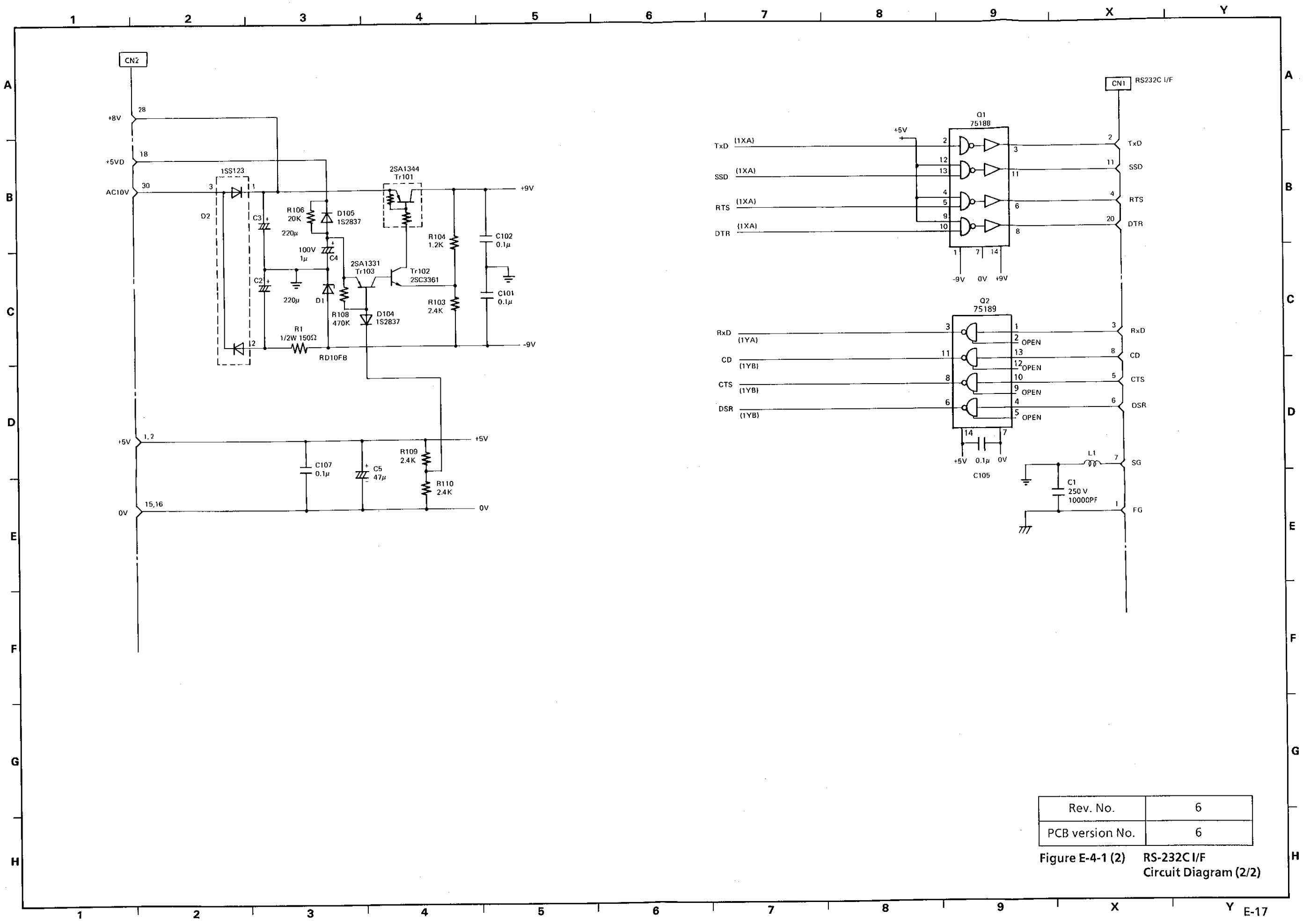

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Figure E-4-1 (2) **RS-232C I/F Circuit Diagram (2/2)**

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